FINAL FORWARD PLANNING STUDY REPORT
OLIN CORPORATION (McINTOSH PLANT) SITE
McINTOSH, ALABAMA

DOCUMENT CONTROL NUMBER
268-WP1-RT-CUZY-1

JUNE 6, 1986

COMPANY CONFIDENTIAL

This document has been prepared for the U.S. Environmental Protection Agency under Contract No. 68-01-6939. The material contained herein is not to be disclosed to, discussed with, or made available to any person or persons for any reason without the prior expressed approval of a responsible official of the U.S. Environmental Protection Agency.

REM II
Atlanta, Georgia

180/18

CDM

environmental engineers, scientists, planners, & management consultants

3 8 00002
CAMP DRESSER & McKEE INC.

1945 The Exchange, N.W., Suite 290
Atlanta, Georgia 30339
404 952 8643

June 6, 1986

Ms. Thu Kim Dao
Remedial Project Manager
U.S. Environmental Protection Agency
345 Courtland Street, N.E.
Atlanta, Georgia 30365

Project: EPA Contract No. 68-01-6939

Document Control No.: 268-WP1-RT-CUZY-1

Subject: Final Forward Planning Study
Olin Corporation (McIntosh Plant) Site
McIntosh, Alabama

Dear Ms. Dao:

Camp Dresser & McKee Inc. (CDM) is pleased to submit the Final Forward Planning Study (FPS) for the Olin Site, McIntosh, Alabama. The final report addresses EPA's comments on the revised draft report.

This report includes a description of the site and its environmental setting, a summary of the history of operations at the site, and a review of the data collected during previous site investigations. Information deficiencies and data gaps are identified to provide a basis for the development of remedial investigation activities.

If you have any questions or comments, please call.

Very truly yours,

CAMP DRESSER & McKEE INC.

Jack T. Camp, P.E.
Site Manager

Richard C. Johnson, P.E.
Associate
Region IV Manager

JTC/pl

180/41

PERFORMANCE OF REMEDIAL RESPONSE
ACTIVITIES AT UNCONTROLLED HAZARDOUS
WASTE SITES (REM II)

EPA CONTRACT NO. 68-01-6939

DRAFT FORWARD PLANNING STUDY REPORT
FOR
OLIN McINTOSH SITE
McINTOSH, ALABAMA

EPA WORK ASSIGNMENT NUMBER: 157-4LB6
REM II DOCUMENT NO.: 268-WP1-RT-CUZY-1

PREPARED BY: _____ 6/6/86
Jack T. Camp, P.E. Date
Site Manager

APPROVED BY: _____ 6/6/86
Richard C. Johnson, P.E. Date
Region IV Manager

TABLE OF CONTENTS

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1.0 INTRODUCTION

This Forward Planning Study (FPS) Report has been prepared by Camp Dresser & McKee Inc. (CDM) Region IV, REM II for the U.S. Environmental Protection Agency (EPA) in response to Work Assignment 157-4LB6 issued July 24, 1985. The Work Plan Memorandum, dated August 13, 1985, summarizes the scope of work for this work assignment.

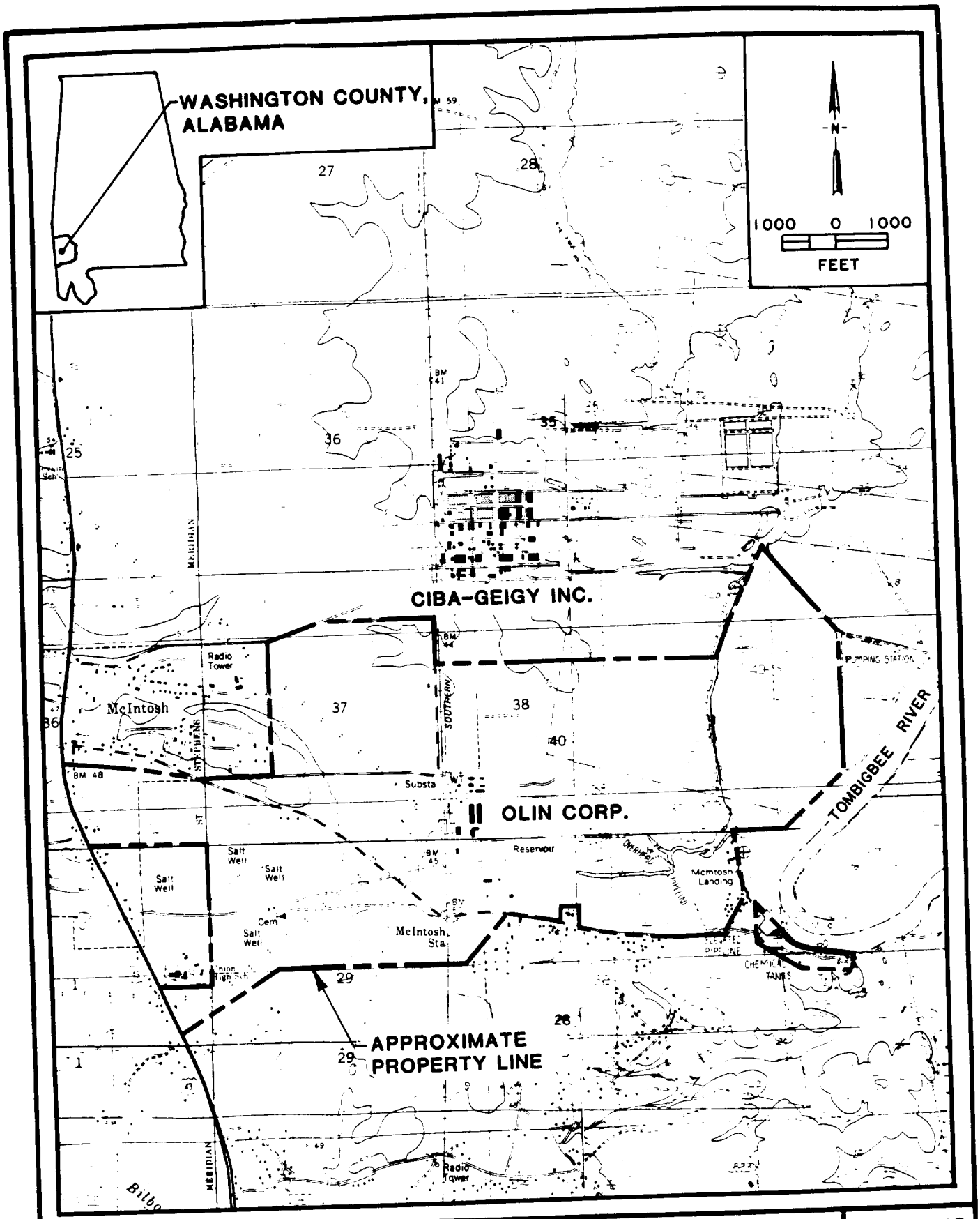
The purpose of the Forward Planning Study is to evaluate the current situation at the site and indicate further endeavors required to satisfy CERCLA requirements. This report includes a description of the site, its environmental setting, a summary of the site history and a review of the data collected during the previous site investigations. Information deficiencies and data gaps are identified to provide a basis for the development of any subsequent remedial investigation activities.

1.1 SITE LOCATION

The Olin Corporation's McIntosh Plant is east southeast of the town of McIntosh, in Washington County, Alabama. The Olin Plant site and associated properties cover approximately 1,500 acres. The site is bound by the Tombigbee River to the east, the Ciba-Geigy Plant to the north and U.S. Highway 43 to the west. An entrance road from U.S. Highway 43 provides access to the plant. Figure 1-1 shows the site location in more detail.

1.2 SITE HISTORY

The organics plant was built by Calabama Chemical Company in 1952. In 1954, Olin Mathieson (predecessor corporation to Olin Corporation) purchased the organics chemical plant from the Calabama Chemical Company. The Pentachloronitrobenzene (PCNB) plant was constructed in 1955 and 1956 with startup of operation in 1956. From 1952 until December 1982, the Olin Corporation operated a mercury cell chlorine-caustic soda plant at the McIntosh facility.



REM II
SITE LOCATION MAP
OLIN CORPORATION
McINTOSH, ALABAMA

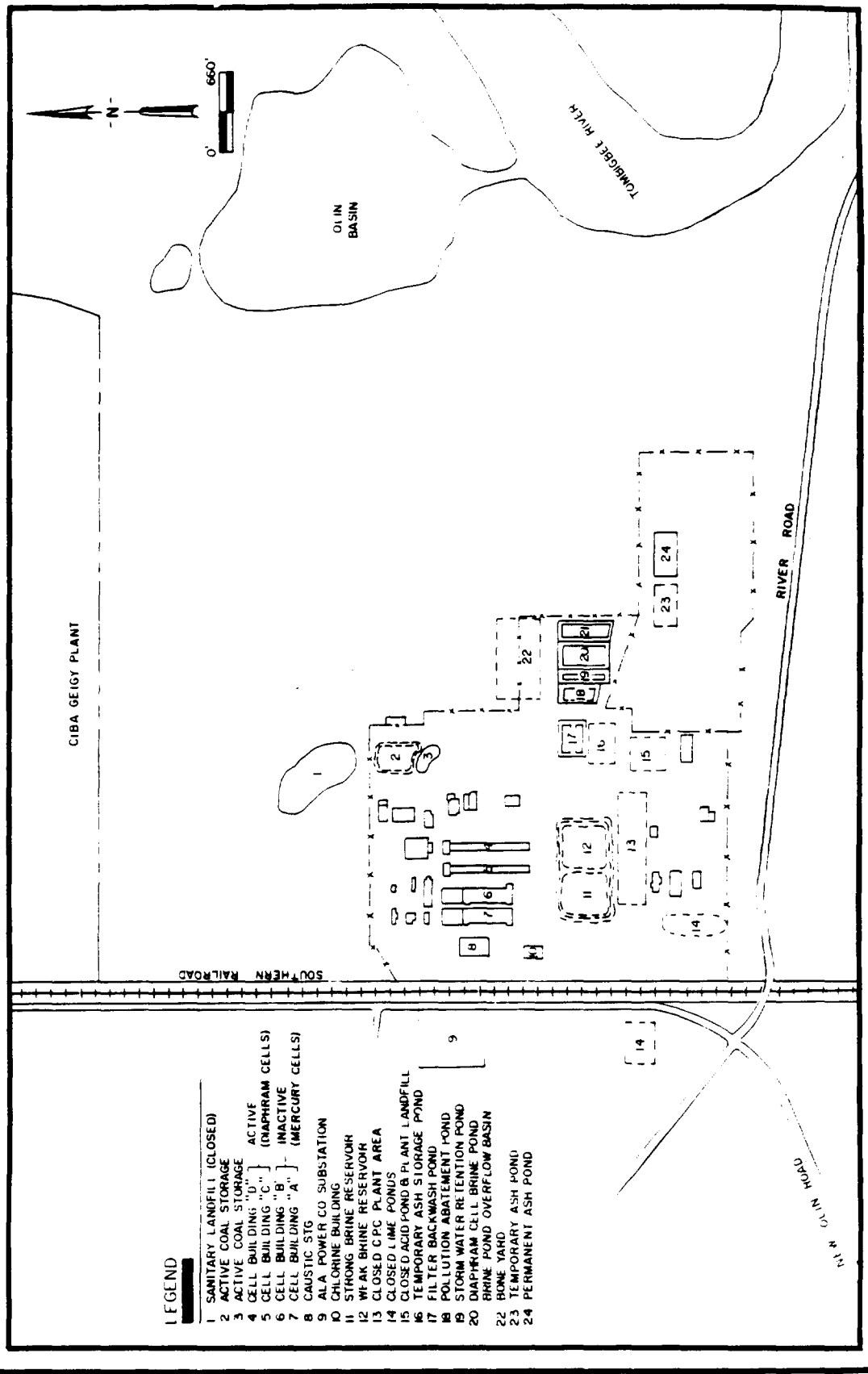
FIGURE NO.
1-1

The plant was later expanded to include the production of trichloro-acetronitrile (TCAN) and 5-ethoxy-3-trichloromethyl-1,2,4-thiadiazole (Terrazole). In 1978, Olin constructed a diaphragm cell caustic soda/chlorine plant which is still in operation. The Olin Corporation McIntosh plant continues to operate today producing chlorine, caustic soda, sodium hypochlorite, sodium chloride and sodium chlorate. (Note: Sodium chlorate is presently produced at the facility for Alby-Olin Chlorates Co.)

In April 1980, the Alabama Department of Public Health (now ADEM) requested that the Olin Corporation install monitor wells at the facility. In July 1980, Olin initiated an internal program to determine if any ground water contamination existed onsite. The program included the installation of 43 monitor wells, 12 of which were installed to comply with current RCRA regulations. The results of Olin's study indicated that the ground water system at the site contained chlorinated organic compounds. EPA then designated the crop protection chemicals (CPC) area shown as No. 13 on Figure 1-2, as a potential hazardous waste site and notified Olin Corporation in May 1981. In December 1982, the entire mercury cell chlorine-caustic soda plant was shutdown; this shutdown included the mercury cells.

In March 1982, Soil & Material Engineers, Inc. was retained by the Olin Corporation to perform a hydrogeologic investigation of the McIntosh Site to assess the migration of organic contaminants. The investigation included the installation of 32 additional monitor wells, and ground water sampling of both new and existing wells. The results of the investigation established the direction of ground water flow and defined the hydrogeologic parameters of the area. The study also identified two major plumes of chlorinated organic contaminants, including concentrations of chloroform, benzene, chlorobenzene and dichlorobenzene.

Olin Corporation installed 14 additional monitor wells between February and March of 1983, in order to further define the migration of the plumes. In



MODIFIED FROM OLIN POST-CLOSURE PERMIT APPLICATION (SEPTEMBER 1986)

REM II

SITE LAYOUT

OLIN CORPORATION

McINTOSH, ALABAMA

FIGURE NO.

1-2

June 1983 the EPA Quality Assurance Sampling Investigation Report indicated the presence of mercury, lead and numerous chlorinated organics.

In September 1983, Olin Corporation began procedures for the capping and closure of the CPC plant area. The closure of the CPC plant area and recapping of the acid pond and plant landfill were completed in late 1984. These projects were completed with the approval of ADEM. Since that time, closure operations for the mercury cell brine ponds and filter backwash, pH and stormwater ponds have continued under RCRA regulation. Likewise, periodic ground water monitoring procedures have been continued under RCRA regulation. The periodic ground water monitoring has also been conducted under Alabama regulations and general agreements with ADEM. A detailed summary of the site history is included in Appendix A for reference.

1.3 SITE STATUS AND PROJECT TYPE

The McIntosh Plant is an active chemical production facility. Current production consists of chlorine, caustic soda, sodium hypochlorite, and sodium chloride. The entire plant is fenced and security clearances are required for entrance.

The Olin McIntosh Site was placed on the National Priority List (NPL) in 1984, at position number 320. It is an enforcement lead site. Camp Dresser & McKee was assigned as REM II contractor for the site on July 24, 1985 to perform forward planning activities.

1.4 ENVIRONMENTAL SETTING

The Olin McIntosh Site is located in a rural unincorporated area. The following sections describe the various physical aspects of the area.

1.4.1 CLIMATE

The McIntosh area has a temperate climate with average monthly temperatures ranging from 48 to 80 degrees Fahrenheit. Precipitation is almost entirely in the form of rain. Local precipitation averages approximately 62 inches

per year. (Appendix B includes monthly totals of precipitation for the area). Generally, the rainfall varies moderately with the driest weather occurring in the fall. Erratic thunderstorms produce most of the summer rainfall resulting in occasional dry spells. The climate of the McIntosh area has a direct effect on the hydrology associated with the site, because rainfall is a major portion of recharge for the shallow ground water system.

1.4.2 TOPOGRAPHY

The McIntosh Site is located within the Southern Pines District of the Gulf Coastal Plain. The topography is generally flat, with elevation ranging from 10 to 60 feet above mean sea level (msl). Figure 1-3 is a topographic map of the area surrounding the site. Surface drainage is primarily westward to Bilbo Creek and eastward to the Tombigbee River.

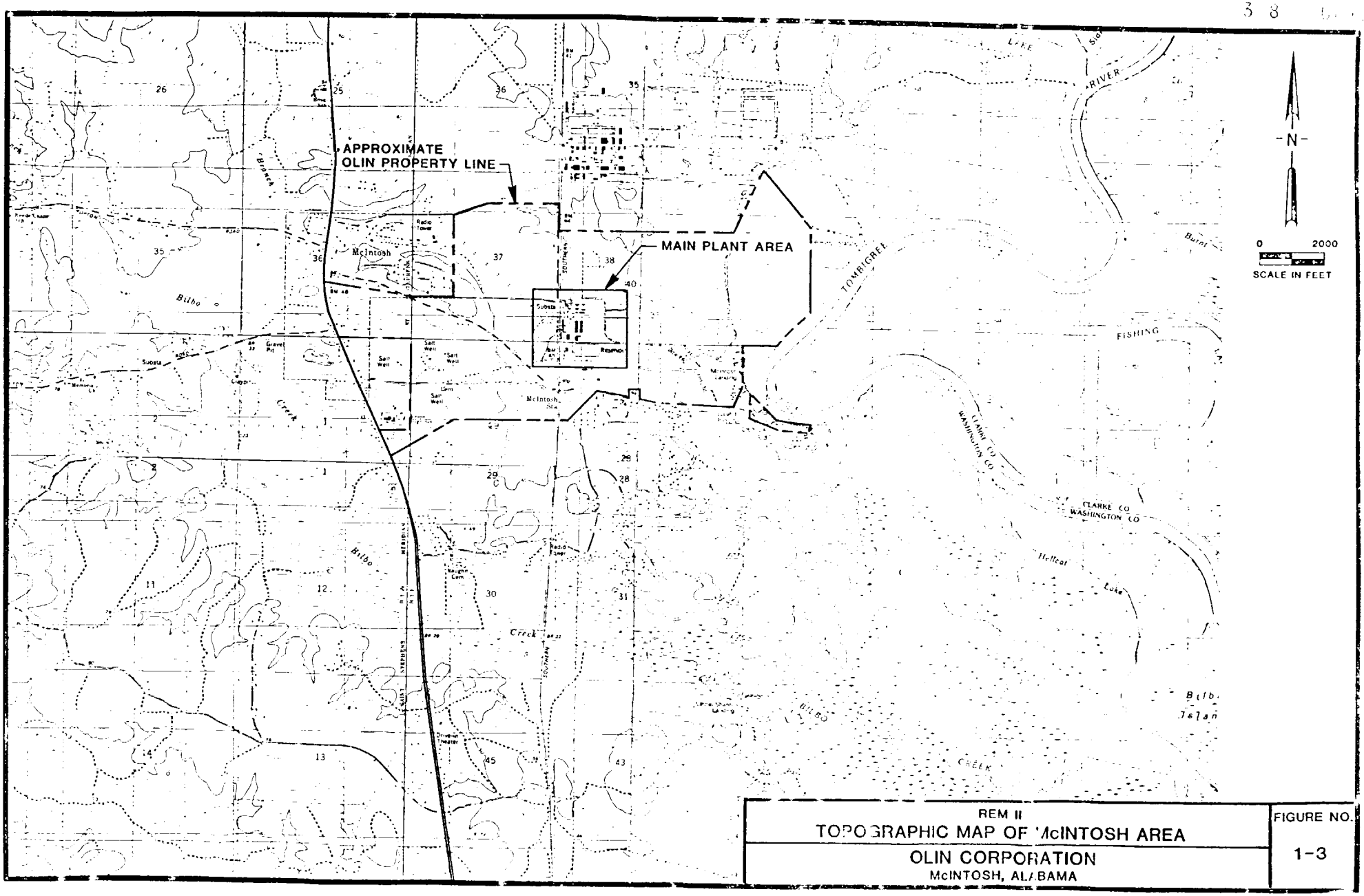
Additional information regarding the general area can be found on the following U.S. Geological Survey Quadrangles:

McIntosh, Alabama - 1982
Bilbo Island, Alabama - 1983 (Provisional Edition)
Ginhouse Island, Alabama - 1984 (Provisional Edition)
Calvert, Alabama - 1982

1.4.3 GEOLOGY

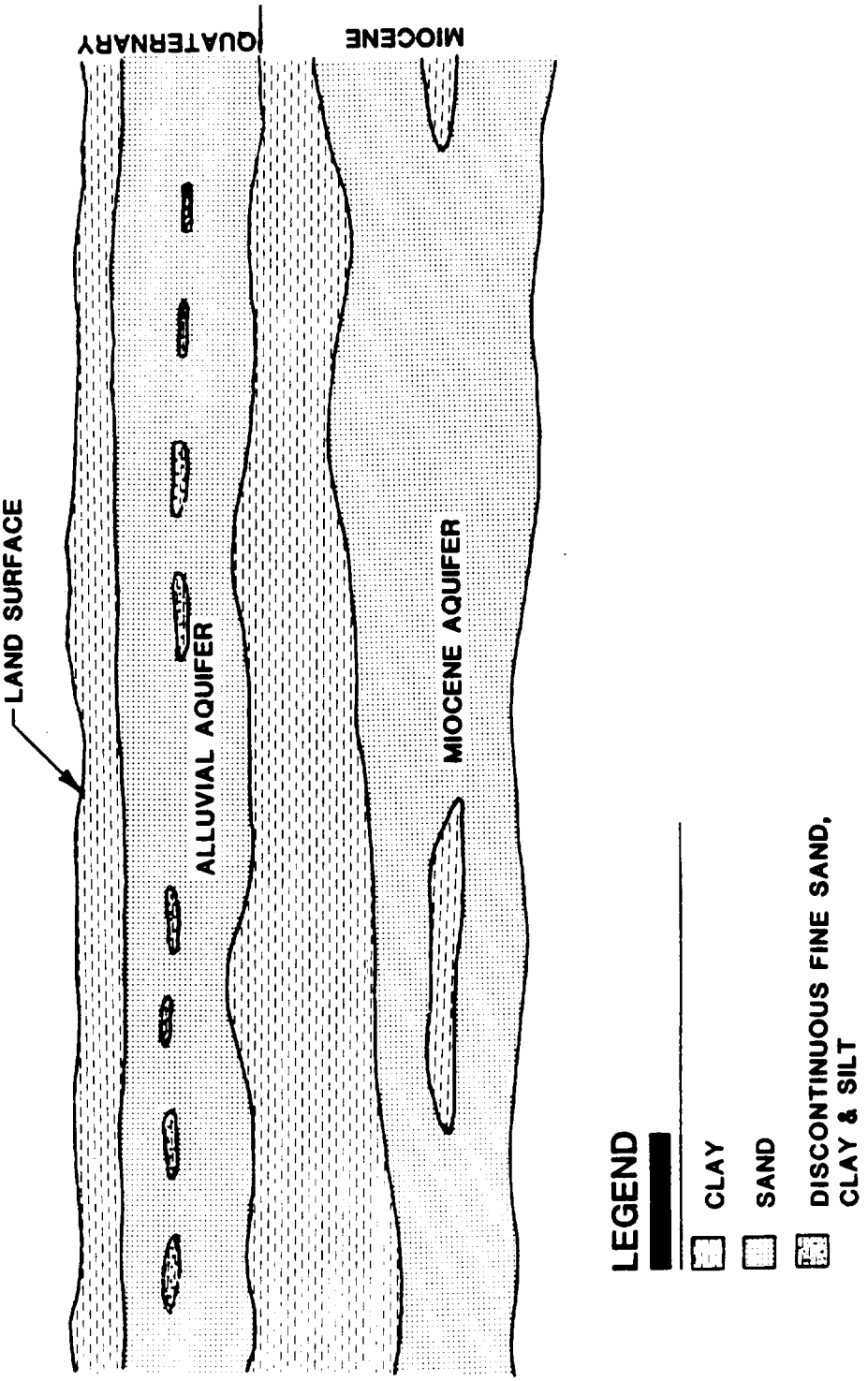
The East Gulf Coastal Plain Province is underlain by sedimentary rocks that dip generally to the southwest at 30 to 50 ft/mi. The general southwestward dip of these sedimentary rocks is locally interrupted by folds, faults, and salt domes. The geologic formations underlying the McIntosh area consist of alternating beds of unconsolidated to consolidated sedimentary units. The McIntosh salt dome is the most distinctive structural feature of the area.

Figure 1-4 represents a generalized cross section of the area. The region of concern (the uppermost 200 feet) consists of two main geologic units.



REM II
TOPOGRAPHIC MAP OF McINTOSH AREA
OLIN CORPORATION
McINTOSH, ALABAMA

FIGURE NO.
1-3



REM II

GENERALIZED GEOLOGIC CROSS SECTION

OLIN CORPORATION

McINTOSH, ALABAMA

FIGURE NO. 1-4

The near surface strata are Quaternary alluvial terrace and flood plain sediments deposited by the Tombigbee River. They range in thickness from 80 to 100 feet forming the Alluvial Aquifer (refer to Section 1.4.5). These sediments consist of beds of sand, gravel, silt, and clay which form the Alluvial Aquifer system. The underlying Miocene unit is also composed of alluvial sediments. A Miocene clay stratum, which varies in thickness from 80 to 100 feet, forms the upper confining layer of the Miocene Aquifer.

1.4.4 SOILS

The uppermost layer of soil in the vicinity of the site generally consists of a low permeability clay ranging in depth from 1 to 15 feet. The soil layer is underlain by Quaternary age sands, gravels, and discontinuous zones of fine sand, clay and silt interbedded with coarser sand and gravel. The soil layer and Quaternary deposits have a combined average thickness of 90 to 100 feet. The hydraulic conductivity of the sands and gravel, which form the Alluvial Aquifer, ranges from 0.011 to 0.028 cm/sec with a porosity range of 20 to 35 percent (S&ME 1982).

The upper Miocene confining layer consists of a continuous blue gray clay, which ranges in thickness from 80 to 100 feet. The Miocene clay has an extremely low vertical permeability with a vertical hydraulic conductivity of less than 1×10^{-8} cm/sec (S&ME 1982). Underlying the clay unit is the Miocene Aquifer, which consists of fluvial sands and gravels.

1.4.5 HYDROGEOLOGY

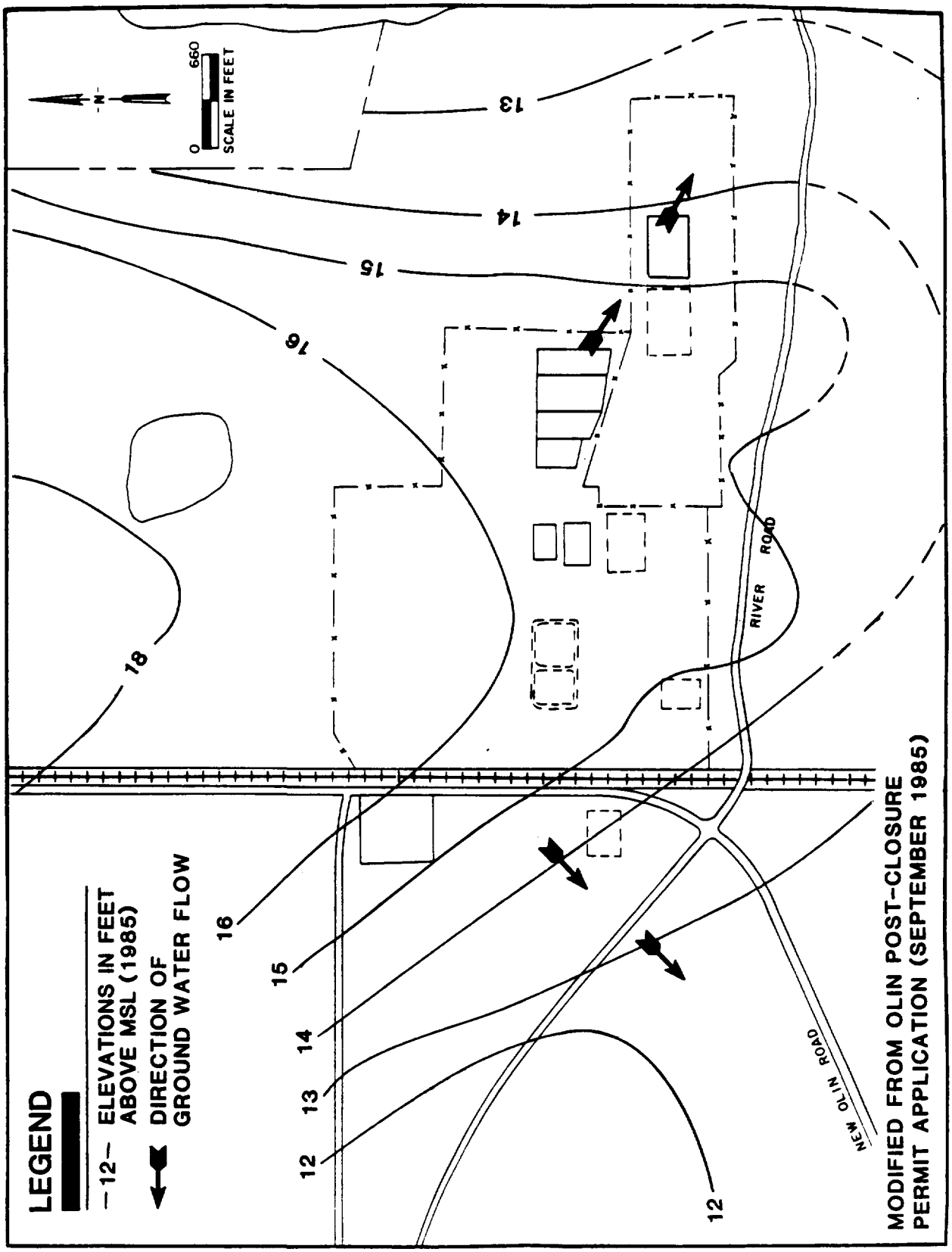
Surface runoff from the site flows both west and south to Bilbo Creek, which discharges into the Tombigbee Creek further to the south. Drainage from the main plant area is through a system of man-made culverts and ditches, which direct the runoff east and northeast toward the Tombigbee River.

Two aquifers are of concern at the site, the Alluvial Aquifer and the Miocene Aquifer, which is a major water supply for the area. To date no

contamination of the Miocene has been detected. The Alluvial Aquifer is semi-confined and contains discontinuous zones of fine sand, clay and silt, however, these zones do not form a hydrologic boundary. The Alluvial Aquifer is directly recharged by infiltration from the site area. The underlying Miocene Aquifer is a confined artesian aquifer, which is not subject to significant leakage from the overlying Alluvial Aquifer. The aquiclude between the Quaternary and Miocene sediments is the thick clay unit described above.

In the Alluvial Aquifer, the ground water generally flows to the site from the northwest. The Alluvial Aquifer thickness ranges from 80 to 100 feet, with a saturated thickness ranging from 45 to 70 feet. Due to the topography of the underlying Miocene confining layer and local site recharge areas, the flow divides and exits the site to the southwest and southeast. The ground water elevations and flow directions in the Alluvial Aquifer are shown on Figure 1-5. The transmissivity of the aquifer varies with the thickness. In the vicinity of the site, the average transmissivity is estimated to be 8,500 ft^2/day, and the specific yield is estimated to be 0.20 (S&ME 1982).

The direction of ground water flow in the Miocene Aquifer is generally to the southwest. However, sufficient information has not been available to develop water elevation contours. The average transmissivity of the Miocene Aquifer is estimated to be 6,950 ft^2/day (P. E. LaMoreaux 1984).



REM II

GROUND WATER GRADIENTS OF THE ALLUVIAL AQUIFER

OLIN CORPORATION

McINTOSH, ALABAMA

FIGURE NO. 1-5

2.0 EVALUATION OF PRESENT SITUATION

2.1 AREAS OF CONCERN

Based upon review of the available background information, the following areas of concern were identified:

- o Onsite waste deposits
- o Soil contamination
- o Ground water contamination

Each of these areas of concern is considered in more detail in the following sections.

2.2 ONSITE WASTE DEPOSITS

Since the start of plant operations, many different chemicals and their associated waste products have been generated at the site. Until the late 1970's many solid wastes were disposed of in landfills onsite. The site became subject to RCRA regulations in November 1980. Approved closure procedures have been completed for the following areas:

- o Acid Pond and Landfill (13)
- o Old Lime Ponds (14)
- o Old Acid Pond and Landfill (15)
- o Filter Backwash Pond (17)
- o pH Pond (18)
- o Storm Water Pond (19)
- o Brine Ponds (11 and 12) - Scheduled for completion in early 1986

Note: Numbers shown in parentheses refer to Figure 1-2.

Details of which wastes were placed in these units and all other solid waste units are defined in the RCRA 3004(u) Questionnaire submitted to EPA

in May 1985 and included as part of the Post-Closure Permit Application in September, 1985 (Section 15, Attachment 15-9, page 15.76-15.81). In addition, the RCRA regulated closure plans for the pH, stormwater, filter backwash and weak brine ponds all specified the amount and quantity of wastes associated with these units. For the pH, stormwater and filter backwash ponds, all wastes were removed as part of the clean closure plans.

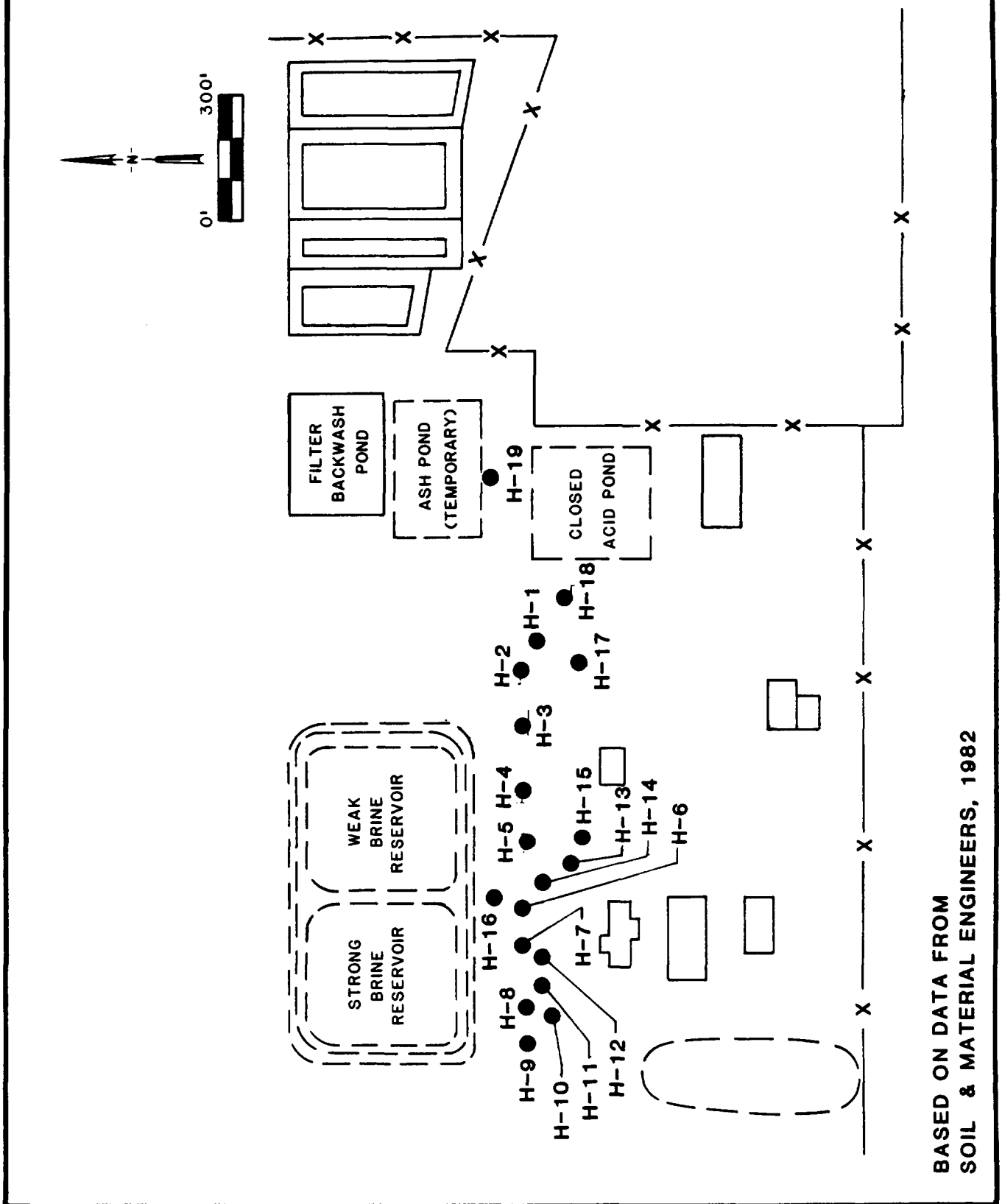
2.3 DEGREE OF SITE CONTAMINATION

2.3.1 SOIL CONTAMINATION

During the 1982 hydrogeology investigation by Soil & Material Engineers, Inc. (S&ME), portable gas chromatograph (GC) readings were taken at the locations shown on Figure 2-1. Readings were taken at 1 foot intervals to a depth of 5 feet. Readings from the portable GC were considered qualitative and were used to evaluate the organics plant area as a possible source of organics in the Alluvial Aquifer beneath the plant site. In order to make the GC data comparable, a "relative response" was calculated for each sample. This relative response number represents the individual peak chromatogram height multiplied by the instrument attenuation factor used during that analysis. These relative response numbers were added for a particular sample and used as a relative or comparative indicator of the presence or absence of organics at the sample location (S&ME 1982). Table 2-1 is a summary of the relative GC responses.

Evaluation of the relative response data taken in 1982 indicates that organic compounds were present in the soil to a depth of at least 5 to 8 feet at most of the 19 locations. The relative response numbers in the upper 1 to 2 feet of soil were generally lower than those recorded for the deeper samples. This was attributed to some leaching or volatilization of the compounds from the soils near land surface.

The CPC plant area has been clay capped and the runoff is controlled by concrete drainage ditches surrounding the area and is directed through the main plant NPDES outfall.



REM II

GAS CHROMATOGRAPH TESTING LOCATIONS

OLIN CORPORATION

McINTOSH, ALABAMA

FIGURE NO. 2-1

TABLE 2-1

SUMMARY OF RELATIVE GC RESPONSES FROM HAND AUGER SAMPLES,
PLANT PROCESS AREA
OLIN SITE
McINTOSH, ALABAMA
REM II

Test Location	Depth (feet)	Summary of Relative Response
H-1	1.0	1,752
	2.0	1,936
	3.0	59,040
	4.0	22,878
	5.0	19,280
H-2	1.0	142
	2.0	217,728
	3.0	184,576
	4.0	116,810
	5.0	101,704
H-3	1.0	276
	2.0	26,516
	3.0	70,256
	4.0	73,952
	5.0	109,516
H-4	1.0	3,496
H-5	1.0	493
	2.0	18,480
	3.0	43,856
	4.0	93,390
	5.0	156,260
H-6	1.0	536
H-7	1.0	1,256
	2.0	772
	3.0	1,126
	4.0	28,904
	5.0	22,346
H-8	1.0	954
	2.0	1,149
	3.0	21,402

TABLE 2-1
(continued)

Test Location	Depth (feet)	Summary of Relative Response
H-9	1.0	511.5
	2.0	1,969
	3.0	418
	4.0	1,940
	5.0	2,284
H-10	1.0	116
	2.0	719
	3.0	4,522
H-11	1.0	6,334
H-12	1.0	364.5
	2.0	248
	3.0	8,550
	4.0	573
H-13	1.0	13,236
	2.0	69,744
	3.0	598,400
	4.0	308,300
	5.0	410,828
H-14	1.0	316
	2.0	3,628
	3.0	33,460
	4.0	190,044
	5.0	253,088
	6.0	479,944
	8.0	612,000
H-15	1.0	3,146
	2.0	49,908
	3.0	1,659,904
	4.0	1,318,400
	5.0	857,500
H-16	1.0	94
	5.0	48

TABLE 2-1
(continued)

Test Location	Depth (feet)	Summary of Relative Response
H-17	1.0	4,588
	2.0	68,576
	3.0	66,048
	4.0	104,784
	5.0	35,716
H-18	1.0	7,292
	5.0	67,467
H-19	5.0	60,928

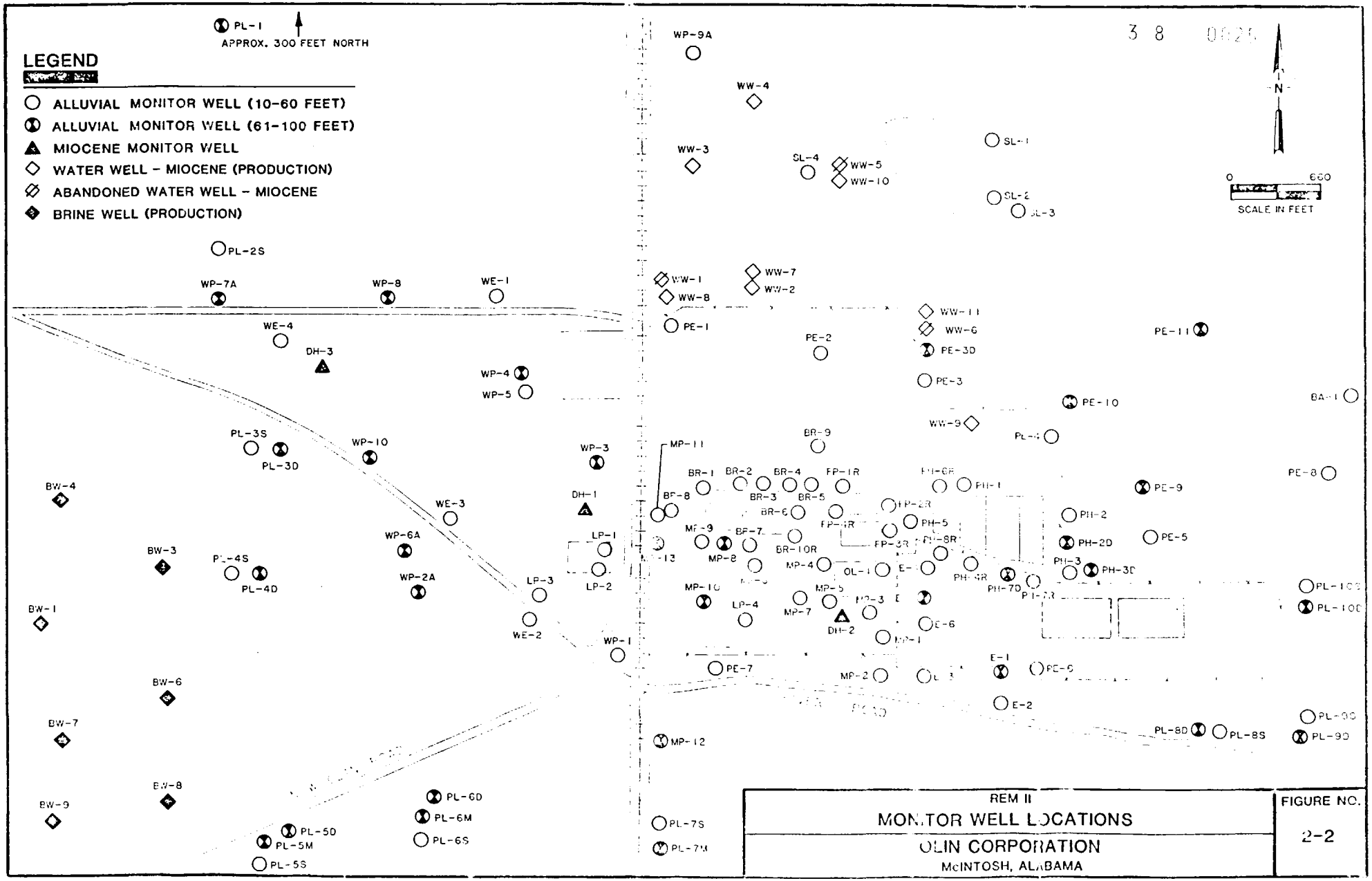
The current NPDES effluent monitoring station was completed in 1978, previous monitoring station was used from 1970-1978. As part of the Environmental Impact Assessment performed in 1977 for the construction of the Diaphragm Cell Chlorine/Caustic Soda Plant, sediment samples in the effluent ditch were taken and analyzed; a copy of that data is included in Appendix C.

2.3.2 GROUND WATER CONTAMINATION

In 1980 Olin Corporation initiated an internal study which included the installation of 43 monitor wells in the Alluvial Aquifer. In 1982, Olin retained S&ME to perform a more extensive study and to install 32 additional wells including 3 wells installed in the Miocene Aquifer. Figure 2-2 shows the locations of all monitor wells installed to date. A Summary of well data is included in Appendix D. The study included only analyses for volatile organics and base/neutral extractables. The Alluvial Aquifer was found to contain concentrations of chloroform, benzene, chlorobenzene, and dichlorobenzene. Table 2-2 shows maximum concentrations detected. (Appendix C contains a complete summary of the organic analyses). The Miocene Aquifer was found to contain no unusual concentrations. The study indicated that the two aquifers are hydraulically separate. The results of this investigation also began to identify and define the migration plumes of the various chlorinated compounds.

In August 1982, EPA collected split samples from 14 of the monitor wells during the S&ME investigation. The results of EPA's analyses further identified concentrations of lead, mercury, and chromium in the Alluvial Aquifer along with the previously mentioned chlorinated organics. Table 2-3 presents these results. Results of analysis conducted by Olin and ADEM did not confirm the presence of lead.

Between February and June 1983, Olin Corporation installed 14 additional monitor wells with the intention of further defining the plume of contaminants moving to the southwest. Quarterly monitoring of the ground



REM II

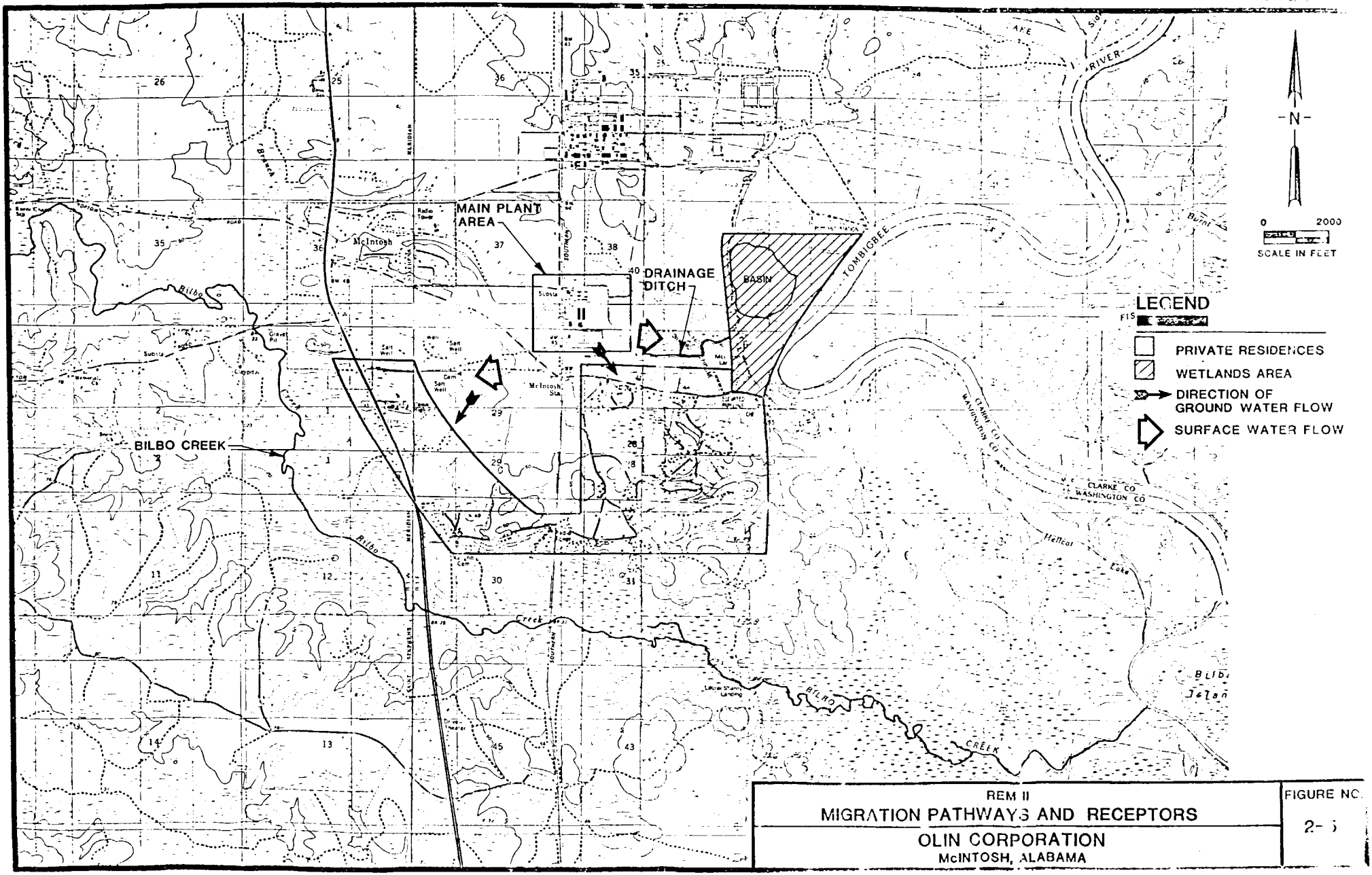
MONITOR WELL LOCATIONS

OLIN CORPORATION

McINTOSH, ALABAMA

FIGURE NO.

2-2



REM II
MIGRATION PATHWAYS AND RECEPTORS
OLIN CORPORATION
McINTOSH, ALABAMA

FIGURE NO.
2-3

TABLE 2-3

SUMMARY OF EPA ANALYSIS (1982)
OLIN SITE
McINTOSH, ALABAMA
REM II

Contaminant	Maximum Concentration Identified (ppb)	Well Location
Metals		
Chromium	(See Note #1) 290	LP1
Lead	(See Note #2) 760	WP-3
Zinc	690	WP-3
Aluminum	120,000	BR-8
Manganese	2,500	LP-1
Iron	60,000	LP-1
Barium	600	LP-1
Nickel	820	WP-3
Cadmium	170	WP-3
Beryllium	62	WP-3
Arsenic	60	PH-3D
Cobalt	860	WP-3
Copper	320	OL-1
Tin	7,600	WP-3
Silver	48	WP-3

Note #1: During the RCRA quarterly monitoring program conducted from December 1981 through August 1982, Olin analyzed 46 monitor well samples for chromium. Six of the samples had levels higher than 50 ug/1, five of which were between 50 and 86 ug/1 with one sample, Well PH-6R, August 1982, at 570 ug/1. The three previous analyses for that well were 10, 16, and 9 ug/1. The 1985 Appendix VIII sampling and analysis for Wells PE-3D, PH-7D, MP-13, WP-2A, and E-1 showed chromium at or below the dectability limit of 10 ug/1 (Post-Closure Permit Application; Section 15, page 15.25, 15.37, 15.62 and 15.74, respectively). Olin believes that the chromium values seen during the August 1982 sampling and analysis were anomalous, perhaps due to an analytical problem.

Note #2: During the RCRA quarterly monitoring program conducted from December, 1981 thorugh August 1982, Olin analyzed 46 monitor well samples for lead (along with the other required parameters). Only one sample was found to be higher than the 50 ug/1 primary drinking water standard with all other samples below 17 ug/1. The one well lead analysis - Well PH-6R, August 1982 - above the standard was 116 ug/1; the three previous lead analysis for that well were all 2 ug/1 (Post-Closure Permit Application, Section 13, pages 13.9-13.12).

TABLE 2-3
(continued)

Contaminant	Maximum Concentration Identified (ppb)	Well Location
Extractable Organics		
1-4 Dichlorobenzene	6,600	LP-4
1-2 Dichlorobenzene	5,800	LP-4
1-2-4 Trichlorobenzene	790	LP-4
Hexachlorobenzene	36	OL-1
2 Chlorophenol	120	LP-4
Napthalene	200	OL-1
Pesticides*		
Beta-BHC	65	OL-1
Gamma-BHC (lindane)	37	OL-1
Purgeable Organics		
Chloroform	16,000	OL-1
Benzene	450	LP-4
Chlorobenzene	8,800	LP-4
Methylene Chloride	200	OL-1

*Subsequent sampling by Olin in December 1981 through August 1982 for the RCRA quarterly monitoring program included these parameters at this and other wells. The highest concentration for lindane detected at that time was 2.64 ppb with an average concentration of .023 for 46 wells sampled.

TABLE 2-2

ORGANIC COMPOUNDS PRESENT IN THE ALLUVIAL AQUIFER (AUGUST 1982)
OLIN SITE
McINTOSH, ALABAMA
REM II

Contaminant	Maximum Concentration Identified (ppb)	Well Location
Benzene	1,638	LP-4
Carbon Tetrachloride	68	LP-4
Chlorobenzene	6,592	LP-4
Chloroform	2,679	MP-13
1-2 Dichlorobenzene	2,418	LP-4
1-4 Dichlorobenzene	3,142	LP-4
1-2-3 Trichlorobenzene	17	LP-4
1-24 Trichlorobenzene	11	LP-4
1,2,4,5 Tetrachlorobenzene	13	LP-4
1,2,3,4 Tetrachlorobenzene	199	LP-4
Toluene	102	LP-4

Reference: S&ME 1982.

water has continued through 1985 and will continue in 1986. The first two 1985 quarterly analysis results are included in Appendix IV of the Post-Closure Permit Application.

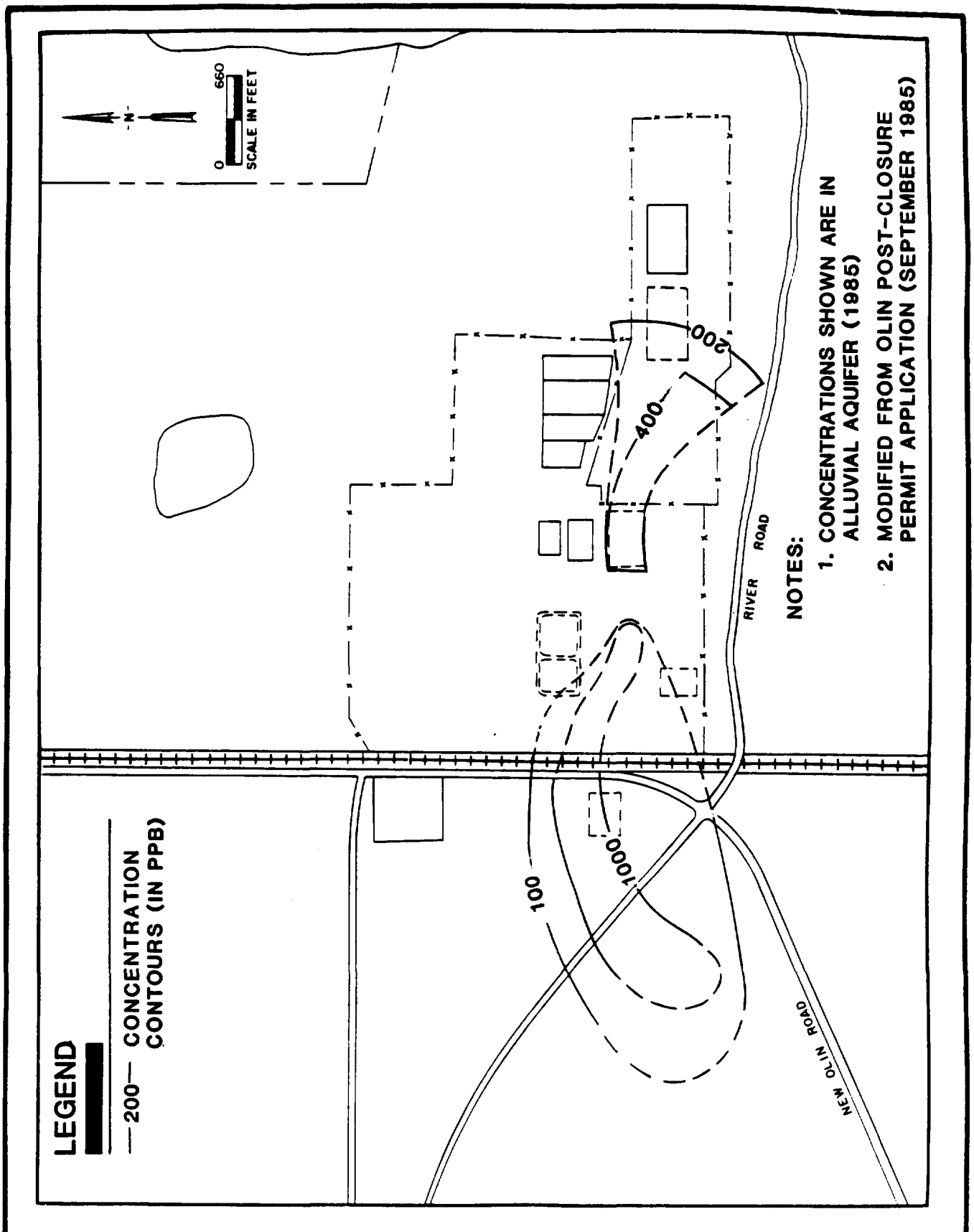
In February 1985, 10 new monitor wells were installed on the east side of the site to further define the migration of contaminants to the east-southeast. Analytical results for samples taken from these wells are included the September 24, 1985 RCRA Post-closure Permit application revision.

Quarterly sampling of various wells has continued since 1982. The results of this sampling program indicate the migration of the contaminant plumes has not extended offsite. Figures 2-3 and 2-4 show the concentration levels for total organics and mercury which are representative of the total contaminant plumes.

2.4 CONTAMINANT MIGRATION PATHWAYS/ENVIRONMENTAL AND PUBLIC HEALTH IMPLICATIONS

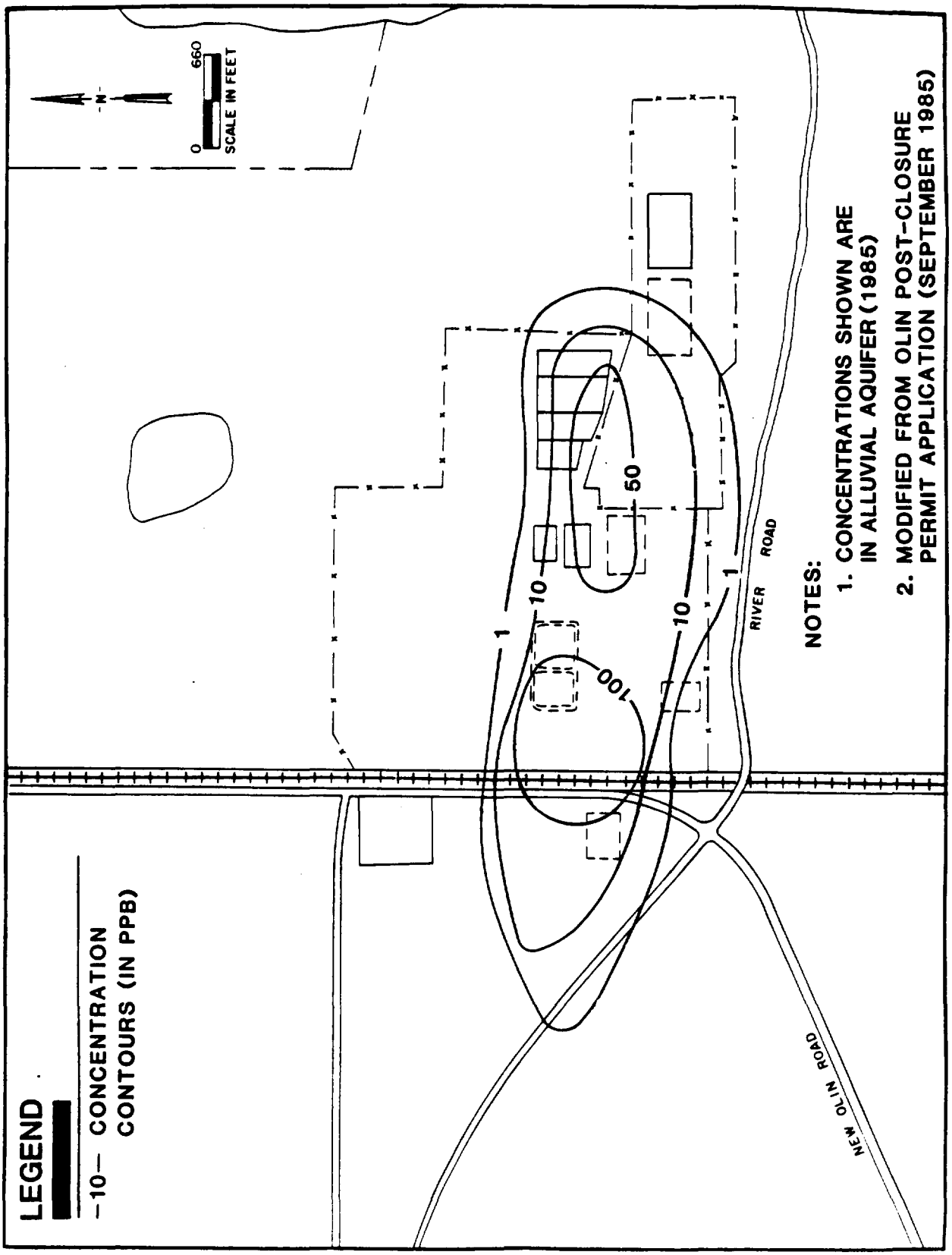
2.4.1 MIGRATION PATHWAYS

In order to achieve the objective of this Forward Planning Study, the potential migration pathways must be identified. The purpose of identification is to determine any pathway which may have previously or which may have any future potential of transporting contaminants. The two pathways of concern at this site are the surface water and the ground water. Figure 2-5 shows these migration pathways. As previously mentioned in the section on ground water, the Alluvial Aquifer is contaminated. The flow in this aquifer has been extensively studied by Olin Corporation and found to be to the south-southwest and southeast. Surface runoff from the plant area is collected by concrete drainage ditches and is directed to the Tombigbee River through the NPDES permitted discharge system. Monitoring and reporting is required pursuant to EPA/ADEM regulations.



REM II
CONCENTRATIONS OF TOTAL ORGANICS
OLIN CORPORATION
McINTOSH, ALABAMA

FIGURE NO.
2-3



REM II

CONCENTRATIONS OF MERCURY

OLIN CORPORATION

McINTOSH, ALABAMA

FIGURE NO.

2-4

2.4.2 POTENTIAL RECEPTORS

The following must be considered as potential receptors for any contaminant which may migrate from this site:

- o The town of McIntosh
- o Local residences to the south and southwest
- o The basin and associated wetland area to the east of the plant
- o The Tombigbee River

The town of McIntosh is the nearest population center to the site. The town uses a well system which draws water from the Miocene Aquifer. Studies to date indicate that the Miocene Aquifer is hydraulically separate from the Alluvial Aquifer. Since the town is located upgradient from the site and to date no contamination has been found in the Miocene Aquifer, there appears to be no risk associated with the town's water supply. However, since the Miocene Aquifer is a major source of water for the area, monitoring should be continued.

Scattered private residences are located both to the south and southeast of the site (Figure 2.5). Although the town of McIntosh supplies water to residences along River Road and McIntosh Bluff Road via pipeline, there is a possibility that some of the residences may use the Alluvial Aquifer as a water source. This should be investigated as part of the risk assessment associated with the RI/FS.

The plant effluent, including surface runoff collected from the plant area, is discharged to the Tombigbee River. Since the effluent has been monitored since 1970 under NPDES permit, the river is a regulated receptor and, therefore, should not be given further consideration under this study. However, since aerial photographs taken prior to 1970 show that the effluent was discharged directly into the basin (refer to Historical Analysis for the site, prepared by the Environmental Monitoring Systems Laboratory for EPA), accumulations of contaminants could have been deposited there. The basin and associated wetland area must therefore be considered as potential receptors. In addition to the biological sampling

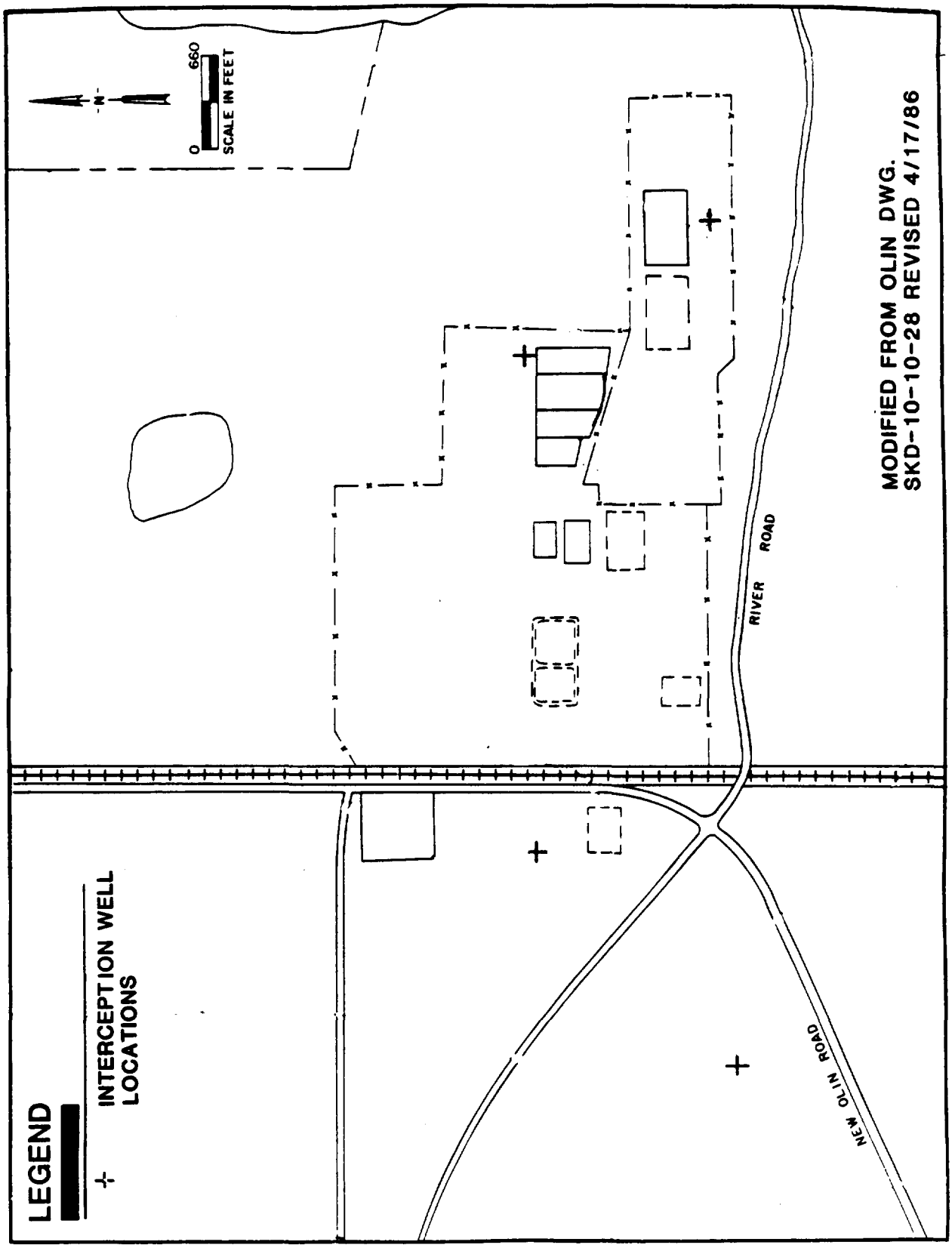
done as part of the 1977 EIA and bioassay tests run in the early 1980's as part of the NPDES permit requirements, the wetland area must be addressed in accordance with Appendix A of 40 CFR Part 6 to satisfy CERCLA policy requirements.

2.5 CURRENT REMEDIAL ACTIONS

The Olin Corporation has been monitoring contamination in the ground water since 1980. They have also submitted a Post Closure Permit Application for the entire facility to RCRA for review, which includes a corrective action program. The proposed program consists of a system to remove and treat ground water to reduce the present concentrations of chemical contaminants to acceptable levels.

Upon completion of the closure of the Weak Brine Pond and drum storage areas, all closures will be complete. However, the entire facility will continue to be monitored under the RCRA Post Closure Permit to be issued by EPA.

The revised corrective action in the RCRA Post-Closure Application will involve the construction and installation of four ground water interceptor wells and a treatment facility. The wells are intended to extract the contaminated ground water and reverse migration of the contaminant plumes. The contaminated water removed by pumping will then be treated by a carbon adsorption process and discharged to the Tombigbee River via the effluent outfall under NPDES permit. The four wells will be installed to a depth of 90 feet and be pumped at a rate of 100 gpm each. Figure 2-6 shows the location of these wells and the approximate outline of the resulting water elevation contours. Olin's Post Closure Plan (January 1985) states that based upon their computer model analysis, the two proposed wells will reverse the direction of ground water flow. The wells will also successfully recover the contaminated water at the furthest extent of the plume, requiring approximately 12 years for the east plume and approximately 20 years for the west plume. Pumping and treatment of the



REM II

PROPOSED CORRECTIVE ACTION PROGRAM

OLIN CORPORATION

McINTOSH, ALABAMA

FIGURE NO. 2-6

ground water will continue until the ground water protection standard is obtained for three consecutive years. Olin will then submit a RCRA permit modification to terminate the corrective action (Post Closure Permit Application, Section 17, page 17-18).

2.6 DATA EVALUATION

In order to meet CERCLA requirements for developing a plan of action for remedial investigation and feasibility study, specific concerns must be addressed. This section identifies those concerns based upon the initial review of available data. It is recognized that appropriate action may have been accomplished, currently be planned, or implemented under RCRA compliance. The interfaces between CERCLA and RCRA concerns will be discussed in Section 4, including any overlapping efforts. The following are the types of items which must be satisfied to comply with CERCLA requirements.

- Any RI/FS Action Plan should include an investigation to identify all possible sources and develop remedial or corrective action for each area. Any area which is suspect because waste has been found nearby or because some discoloration or stress is indicated in aerial photography should be investigated. Investigations should also include interviews with longtime or retired employees and the use of geophysical methods to ascertain locations which may contain hazardous waste. Calibration of the survey over the known disposal area should be performed prior to use in unknown areas.

- Research of Olin's records should be conducted to identify the types and quantities of hazardous materials disposed of onsite.

- Leachate samples should be taken at any observable leachate streams. Soil samples should be taken at all suspected fill areas. Soil and leachate samples should be taken in conjunction with the source identification effort.

- Sediment samples should be taken in all surface runoff channels with particular emphasis on the effluent drainage ditch. Consideration for remedial actions should be included in future RI/FS work if any contamination is present.

- The wetland area should receive a more intensive investigation of both sediment/water and biota. The investigation should concentrate on identifying any contamination which could have resulted from plant discharge into the basin and associated wetland area.

- Both the lateral and vertical extent of the pollutant plumes should be defined. Analytes should be determined on the basis of known pollutants and a sampling effort be made to collect samples from all levels of the surficial aquifer. The file data indicate that the Miocene Aquifer has not and is not likely to be affected by the contamination of the surficial aquifer. Current quarterly monitoring under RCRA ground water assessment confirm a lack of contamination. Monitoring is scheduled to be continued under RCRA during the post-closure period. Any further study of the Miocene Aquifer under the RI/FS should not be necessary.

3.0 PRELIMINARY ASSESSMENT OF REMEDIAL ALTERNATIVES

A preliminary assessment of remedial alternatives must be conducted on all NPL sites in order to comply with CERCLA requirements. The purpose of conducting a preliminary assessment of remedial alternatives is to identify alternative approaches for site remediation, to establish criteria to evaluate the alternative approaches, and to relate these alternatives to the data requirements outlined in Section 4. Initial screening of the identified alternatives is based upon cost, acceptable engineering technology, and effective contribution to the protection of public health, welfare, and the environment.

This section identifies remedial action categories, presents criteria for evaluating those categories, and indicates data needed to formulate, screen, and evaluate alternatives within the categories.

During the performance of an RI/FS, at least one remedial alternative should be identified within each category listed below unless there is strong rationale for eliminating a category. The no action category must not be eliminated. Refer to Appendix E for additional information regarding remedial approaches and technologies.

- o Offsite treatment or disposal
- o Complies with all applicable and/or relevant federal public health or environmental standards
- o Exceeds requirements of all applicable and/or relevant federal public health or environmental standards
- o Does not comply with applicable or relevant federal public health standards but will reduce the likelihood of present or future threat from the hazardous substances or pollutants or contaminants
- o No action

The following sections provide examples of each category. Other possible remedial alternatives are listed in Appendix E.

3.1 OFFSITE TREATMENT OR DISPOSAL ALTERNATIVES

Source Control

Source control through offsite treatment or disposal will first require excavation of all source material. The type and extent of source material will be identified during the RI/FS, but will most likely include contaminated soil and swamp sediments, waste sludge, and drummed wastes. Excavated areas must be filled with clean material, compacted, and graded. Following excavation, the source material must be transported to a treatment or disposal facility using trucks or train cars.

Treatment and disposal options include chemical, biological, or physical treatment of contaminated soils, and/or secure landfill disposal. During the RI/FS, potential treatment and disposal areas and limitations for each, must be identified.

Management of Migration

Management of contaminant migration through offsite treatment or disposal will first require extraction of the contaminated ground water. Once the contaminated ground water is extracted, it must be transported offsite along with any contaminated surface water. The contaminated water may be transported offsite via newly constructed pumping and piping systems, drainage ditch systems, or by truck or train tankers, depending on the location of the treatment or disposal facilities. Offsite treatment may entail air stripping, carbon filtration, steam stripping, vacuum flash expansion, resin adsorption, condensation, chemical precipitation, flocculation, sedimentation, filtration, solvent extraction, dissolved air flotation, biological degradation, chemical oxidation, uv/ozonation, reverse osmosis, ultrafiltration, ion exchange, or electrodialysis. Contaminated water could also be discharged directly to surface water bodies. Additional information regarding anticipated variations in contaminant concentrations is required prior to evaluation of the disposal without treatment alternatives.

3.2 COMPLIANT ALTERNATIVES

Compliant alternatives are those which attain applicable and/or relevant state and federal public health or environmental standards.

Source Control

Source control remedial alternatives which comply with applicable and/or relevant public health or environmental standards, involve segregation of the contaminated material from the ground water or surface water system. Slurry walls, grout curtains, or sheet piling may be used for segregation. Sources may also be treated by in situ biodegradation or chemical fixation. They may be disposed of onsite by lining the excavated areas and then replacing excavated contaminated soils.

Management of Migration

Management of migration of contaminants will require removal of contaminants from the ground water and surface water so that pollutant concentrations meet the EPA National Safe Drinking Water Standards or other applicable standards. This can be accomplished by the currently proposed onsite treatment operations.

To choose this alternative, the volume and treatability of contaminated water will have to be ascertained. Onsite treatment may entail the same processes as those listed for offsite treatment. Treated water may be disposed of by land spreading or discharge to surface waters. Any residuals created may have to be analyzed to determine if it must be handled as a hazardous waste.

3.3 ALTERNATIVES EXCEEDING STANDARDS

To exceed requirements of all applicable and/or relevant state and federal, public health or environmental regulations, total removal of all contaminants that exceed naturally occurring concentrations may be required.

Source Control

Source control remedial alternatives which facilitate total removal of all contaminants involve complete segregation of the contaminated material from interaction with the ground water or surface water system, and subsequent elimination of the contaminated material. Removal of the contaminated material may be accomplished by excavation and disposal offsite.

Management of Migration

Management of migration of the contaminants to facilitate exceeding all applicable and/or relevant public health and environmental standards may require total removal of contaminants from the ground water and surface water. Total removal of contaminants could be accomplished by onsite treatment operations, or by transporting the contaminated water offsite for treatment and disposal.

To choose this alternative, the volume and treatability of contaminated water will have to be ascertained. Onsite treatment may entail the same processes as those listed for offsite treatment. Disposal of treated water may be accomplished by land spreading or discharge to surface waters. Any residuals created may have to be analyzed to determine if it must be handled as a hazardous waste.

3.4 NON-COMPLIANT ALTERNATIVES

Management of Migration

A non-compliant alternative reduces the hazard encountered from the contamination and manages the migration of the pollutants, but does not remove or contain the sources. Treating the contaminated water without remediating the sources of contamination would eliminate or reduce the hazard of migration, but would not be an effective solution against further contamination.

Treatment of the contaminated water may occur onsite or offsite. In order to justify selection of this alternative, a determination of the total quantity of source material, and an evaluation of the rates and routes of migration of the contaminants is required. A detailed risk assessment must also be conducted before this alternative can be chosen. This alternative is viable if potential health and environment factors are addressed.

3.5 NO ACTION ALTERNATIVE

Source Control

Under the no action alternative, the source would not receive any further remedial actions. In order to justify selection of the no action alternative, a determination of the total quantity of the source material and its contaminant concentrations is required. An evaluation of the rates and routes of the migration of contaminants must also be addressed.

Management of Migration

Under the no action alternative, no further programs would be implemented to control contaminated ground water plumes or the surface migration of contaminants. Before this alternative can be selected, the potential extent and rate of migration of the contaminants must be determined and the potential future downstream receptors must be identified. This evaluation will require collecting the data necessary to produce a pollutant transport model of the area. This alternative is viable if potential health factors are addressed and rates of migration and impact on potential receptors can be ascertained. A detailed risk assessment must be conducted before this alternative can be chosen.

4.0 OBJECTIVES OF THE REMEDIAL INVESTIGATION

A remedial investigation is a field-oriented data gathering effort designed to:

- o Characterize the contamination present at a site
- o Define the extent of contamination both on and offsite
- o Develop viable remedial action alternatives
- o Provide the data base to evaluate remedial action alternatives in a feasibility study

The primary objective of the remedial investigation is to collect an adequate amount of data to evaluate the concerns which are described in Section 2.6 of this document. However, at the Olin Site many of these concerns have been addressed under various RCRA compliance actions. The following sections indicate the status of the previously identified concerns.

- o With regard to the identification of possible sources and quantities of hazardous material disposed of onsite, the 3004(u) Questionnaire submitted on May 20, 1985 and included in the Post Closure Permit Application (Section 15, page 15.76) included all solid waste management units both closed and existing. The information was based upon plant records and interviews with plant personnel (and other Olin personnel) who had been at the plant since the early 1950's. Similar work was done by Soils and Materials Engineers in their study in 1982. Based upon the results of these studies no further action should be needed to satisfy CERCLA compliance.

- o The surface drainage collection system constructed in 1980-81 has directed all surface runoff to the effluent drainage ditch. Since the effluent ditch is a regulated discharge under NPDES permit, no further action should be required under CERCLA compliance to investigate surface runoff or the sediment in the effluent channel.

- Although there is no apparent stressed vegetation in the wetland area and the current regulated plant effluent does not direct discharge into the basin, the wetland area is still a concern due to past activity. Since aerial photographs included in the site's Historical Analysis show direct effluent discharge into the basin prior to 1970, the basin must be considered as a possible receptor of contaminants. In addition to sampling efforts done as part of the 1977 Environmental Impact Assessment and bioassay tests performed as part of the NPDES permit requirement, the wetland area must satisfy CERCLA compliance. The CERCLA policy with regard to floodplains and wetlands is that RI/FS actions must meet the substantive requirements of the Floodplain Management Executive Order (E.O. 11988), and the Protection of Wetlands Executive Order (E.O. 11990), and Appendix A of 40 CFR Part 6, entitled Statement of Procedures on Floodplain Management and Wetland Protection.

- All monitor wells have been sampled and analyzed. The extent of ground water contamination has been identified and a remedial action plan proposed. This information is all available in the RCRA Post Closure Permit Application. In addition, approximately 5% of the wells have been subjected to Appendix VIII screening; these results are also available in the Post Closure Permit Application. Based upon the results of these actions, no further investigations should be required to satisfy CERCLA compliance.

- With regard to public health risk associated with the site, information ascertaining the potential for risk, migration pathways, rates of migration, concentration and toxicity, was submitted to EPA on August 8, 1985 in the Exposure Information Report as required by EPA Regulation 40 CFR 270.10(j).

In conclusion, the results of the previous studies and current corrective actions performed under RCRA compliance have addressed the areas of concern in sufficient detail to satisfy the RI/FS requirements of CERCLA compliance

with the exception of the CERCLA policy requirements with regard to protection of wetlands and 40 CFR Part 6.

This area should be included in any future plan of action in order to satisfy CERCLA compliance requirements. The best course of action would be to include the wetlands within the RCRA compliance activities if possible. If not, the wetlands should be addressed in a separate CERCLA plan of action.

REFERENCES

1. CDM. 1985. Work Plan Memorandum for Olin Corporation (McIntosh Plant) Site, (268-WP1-WP-BHVS-1).

2. Soil & Material Engineers Inc. 1982. Report of Hydrogeologic Investigation, McIntosh Alabama Site.

3. Olin Corporation. 1985. (Revised November 1985). RCRA Post Closure Permit Application.

4. Olin Corporation. 1983. McIntosh 1983 Ground Water Status Report.

5. Olin Corporation. 1985. McIntosh 1984, Ground Water Status Report.

6. P. E. LaMoreaux and Associates. 1984. Hydrogeology of the Ciba-Geigy Corporation Plant Site at McIntosh, Alabama.

APPENDIX A

SUMMARY OF SITE HISTORY

APPENDIX A

SUMMARY OF SITE HISTORY FOR THE OLIN CORPORATION McINTOSH PLANT

1951	-	Olin purchased the plant from the Calabama Chemical Company.
1952	-	Olin began operating a mercury cell chlorine-caustic soda plant. Brine sludges containing mercury were sent to the weak brine pond.
1956	-	Olin constructed a pesticide/organics plant onsite.
1970	-	Use of the acid neutralization pond was discontinued.
1970-76	-	The acid neutralization pond was used as a landfill and covered with clay in 1976.
1972	-	New filter backwash ponds were constructed for mercury cells.
1978	-	Drainage improvements were made to the overall plant.
Late 1979	-	EPA and Alabama Department of Public Health recognized Olin as a potential hazardous waste site.
November 1979	-	The plant came under RCRA regulation.
1980	-	Alabama Department of Public Health requested Olin to install monitor wells.
July 1980	-	Olin initiated an internal study. Thirty four monitor wells were installed; later nine more were added. Twelve of the wells were installed to comply with RCRA regulations. Results of the internal study showed that the alluvial aquifer was contaminated with chlorinated compounds. (The source was believed by Olin to be the old acid plant landfill.)
1980-81	-	Drainage improvements were made to the overall plant. Surface runoff was directed to the Tombigbee River.
March 1982	-	Soil & Material Engineers, Inc. (S&ME's) was retained to perform a hydrogeologic investigation.
May-August 1982	-	S&ME 36 drilled 36 test holes and converted 32 to monitor wells.
December 1982	-	Olin Corporation shut down the mercury cathode cells.

November 30, 1982 - Olin submitted S&ME's report of the hydrogeologic investigation to EPA. Contamination of the alluvial aquifer was confirmed. (High concentrations of chloroform, benzene chlorobenzene and dichlorobenzene).

February-June 1983- Olin installed 14 monitor wells west of the plant area.

June 1983 - EPA Quality Assurance Sampling Investigation identified mercury, lead, and numerous organics in the ground water (alluvial aquifer) at the Olin Site.

September 1984 - The Olin McIntosh Site was placed on the National Priority List.

September 1983 - Olin submitted a proposal for capping and closure of the old landfill and CPC plant area.

December 30, 1983 - Olin issued 1983 ground water status report which indicated that the organic contaminant plumes had not migrated offsite.

1984 - CPC plant closure was completed.

January 1985 - Olin submitted post closure permit application for weak brine pond.

February 1985 - Olin installed 10 additional monitor wells on the east perimeter of the plant.

May 1985 - Olin submitted 1984 ground water report results indicating that the plumes continued to migrate, but were still contained onsite.

APPENDIX B

MONTHLY PRECIPITATION

APPENDIX B

MONTHLY TOTALS OF PRECIPITATION FOR THE PERIOD OF RECORD 1965 THROUGH 1982 (ATMORE AND BAY MINETTE, ALABAMA STATIONS)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1965	6.76	8.43	6.01	1.81	0.64	5.91	7.33	4.05	7.01	2.86	1.50	4.06	56.37
1966	4.82	9.03	3.37	2.27	2.33	4.19	4.39	8.08	1.90	4.41	8.28	4.93	58.00
1967	7.11	5.59	1.98	2.27	3.62	4.90	6.60	8.00	4.95	4.75	0.66	5.90	56.33
1968	3.31	2.91	1.50	2.39	6.39	4.34	4.21	4.94	2.24	1.25	4.66	10.00	48.14
1969	2.70	5.45	8.19	4.36	7.43	4.55	11.23	9.41	0.59	2.67	0.82	8.24	65.64
1970	2.70	5.12	7.87	1.09	3.36	8.93	4.04	7.90	2.03	5.54	2.45	7.50	58.53
1971	2.73	8.82	5.35	2.86	2.22	3.93	7.18	6.46	7.31	Trace	2.10	6.05	55.01
1972	4.85	3.64	3.98	2.39	9.57	5.30	4.49	4.50	2.38	1.53	5.01	9.95	57.59
1973	4.31	7.96	7.35	3.82	3.73	5.77	5.27	8.37	10.28	0.44	4.37	4.19	65.86
1974	10.05	4.09	5.77	4.30	4.54	3.36	6.96	4.95	15.56	0.48	4.17	3.96	68.19
1975	3.33	7.64	7.95	8.94	7.63	4.69	11.77	6.68	8.97	3.80	4.75	8.38	84.53
1976	2.73	3.84	5.10	1.75	11.44	3.25	5.47	3.01	3.06	4.00	6.15	3.84	53.64
1977	6.06	2.56	8.40	1.48	0.73	2.04	6.09	11.75	5.59	3.44	4.67	6.02	58.83
1978	12.27	3.70	4.37	5.24	8.01	8.98	5.62	5.03	4.55	0.15	4.71	4.88	67.51
1979	7.74	11.23	7.52	4.70	4.49	3.86	11.58	5.93	8.71	0.92	5.92	3.56	76.16
1980	6.82	1.27	12.42	12.86	11.66	8.86	4.98	3.47	5.95	3.55	4.76	1.32	77.92
1981	1.19	9.39	4.80	1.29	6.60	4.45	4.18	5.14	1.45	0.91	1.31	8.23	48.94
1982	6.23	6.75	3.71	3.61	4.57	7.59	7.13	8.71	3.88	1.35	3.37	6.88	63.78
AVERAGE	5.32	5.97	5.87	3.75	5.50	5.27	6.58	6.47	5.36	2.34	3.87	5.99	62.28

APPENDIX C

- SUMMARY OF ORGANIC ANALYSES, 1982
- EPA SPLIT SAMPLE ANALYSIS, AUGUST 1982

SUMMARY OF ORGANICS ANALYSES FROM SELECTED WELLS, JANUARY, 1982

WELL NO.	1,1 DICHLOROETHYLENE	CHLOROFORM	CARBON TETRACHLORIDE	TRICHLOROETHYLENE	CHLOROBENZENE	1,1,1 -TRICHLOROETHANE	TOLUENE	1,2 DICHLOROBENZENE	1,4 DICHLOROBENZENE	1,3 DICHLOROBENZENE	1,2,3 TRICHLOROBENZENE	1,2,4 TRICHLOROBENZENE	1,2,4,5 TETRACHLOROBENZENE	1,2,3,4 TETRACHLOROBENZENE	PENTACHLOROBENZENE	HEXACHLOROBENZENE	BENZENE	1,1 DICHLOROETHANE	1,2 DICHLOROETHANE	1,1,2 TRICHLOROETHANE	TETRACHLOROETHYLENE	1,1,2,2 TETRACHLOROETHANE	PENTACHLOROBENZENE
BR-8	2.1	736	0.8	0.4	165		33.4	406	513	52.7	16.6	27.6	8.5	120	28.4	0.02	17.2						5.8
BR-10R	1.2	74.1		>0.2	1.1	0.2	28.3	0.02	0.007			0.005	0.08	1.6	10.9	0.5	0.3					0.7	1.7
[illegible]-2	2.6	8.6	3.4	0.6	0.1	6.1	25.0	0.009	0.3			0.02	0.02	0.08	0.04	1.0	0.1	8.8					
[illegible]-5		1.8					16.0						0.0006	0.009	0.07		0.1						
[illegible]-7	5.3	21.3					28.0							0.004	0.03	0.05							
LP-1		118	5.4	<0.1	> 1574		30.3	787	1194	52.5	5.3	23.5	2.6	26.7	1.9		178						
LP-2		48.3	<0.1		102.5		22.6	65.1	102	3.1	0.4	1.3	0.04	1.2	0.04		1.8						
LP-3	2.6				92.1		17.8	78.2	105	4.0	0.8	2.9	0.2	1.6	0.04		2.0				1.1		
LP-4	0.1	31.9	9.8	0.5	> 1691	2.1	51.1	3511	4088	354	23.8	281	41.7	217	24.3	0.6	>545			0.4			0.5
ML-1	0.7	2.3			15.9		24.0	22.0	29.6	0.6	0.2	1.4	0.03	1.4	0.008		0.4						
ML-2		0.2			0.2		22.7	0.02	0.005						0.001		0.2						
ML-3	2.9	343	34.6		563	0.3	39.5	269	387	18.5	5.1	26.7	3.7	46.4	1.6		0.4				1.0		
ML-4		0.9			45.1		25.9	40.9	62.8	1.9	0.2	1.0	0.03	0.7	0.07	0.03	0.7				<0.1		
MW-3					0.1		5.3										1.2						
MW-[illegible]					20.4		4.7	13.8	12.9			0.1		0.2			0.7						
PW-4		54.3	<0.1	0.3			79.8	0.01	0.1	0.3	0.1	00.3	1.0	2.8	5.4	1.3							
PW-5		73.1		0.8	0.3	1.6	38.0	0.1	0.2	0.5	2.4	0.1	0.3	4.3	4.4	0.9	0.4						
WL-1	3.2	>3287	13.9	1.0	>938	24.7	29.4	778	620	64.5	37.2	253	51.9	290	62.10	1.8	82.5		10.7				15.1
TPA		6.5					5.9									0.007							

NOTES: 1) All Concentrations in ppb
2) Wells Sampled and Analysed by Olin Chemicals Group
3) Sample Date, January 27, 1982
4) TPA - McIntosh Town Water

SUMMARY OF ORGANIC ANALYSES FROM SELECTED WELLS, MARCH, 1982

	1,1 DICHLOROETHYLENE	CHLOROFORM	CARBON TETRACHLORIDE	TRICHLOROETHENE	CHLOROBENZENE	1,1,1-TRICHLOROETHANE	TOLUENE	1,2-DICHLOROBENZENE	1,4-DICHLOROBENZENE	1,3-DICHLOROBENZENE	1,2,3-TRICHLOROBENZENE	1,2,4-TRICHLOROBENZENE	1,2,4,5-TETRACHLOROBENZENE	1,2,3,4-TETRACHLOROBENZENE	PENTACHLOROBENZENE	HEXACHLOROBENZENE	BENZENE
BR-4	N/M	<1	<1	N/M	<1	<1	<1	53	N/M	67	N/M	<10	N/M	N/M	N/M	<10	8
BR-7	N/M	381	<1	N/M	20	<1	13	<10	N/M	85	N/M	<10	N/M	N/M	N/M	<10	10
BR-8	N/M	1074	<1	N/M	481	<1	41	325	N/M	443	N/M	26	N/M	N/M	N/M	<10	78
BR-10R	N/M	<1	<1	N/M	<1	3	<1	63	N/M	<10	N/M	<10	N/M	N/M	N/M	<10	8
LP-1	N/M	617	<1	N/M	4729	6	83	N/M	N/M	N/M	N/M	N/M	N/M	N/M	N/M	N/M	469
LP-2	N/M	N/M	NM	N/M	N/M	N/M	N/M	122	N/M	<10	N/M	<10	N/M	N/M	N/M	<10	
LP-3	N/M	7	<1	N/M	156	<1	35	87	N/M	<10	N/M	<10	N/M	N/M	N/M	<10	12
LP-4	N/M	1044	<1	N/M	17919	<1	102	N/M	N/M	N/M	N/M	N/M	N/M	N/M	N/M	N/M	1701
ME-3	N/M	<1	<1	N/M	440	<1	30	423	N/M	<10	N/M	<10	N/M	N/M	N/M	<10	28
ME-4	N/M	<1	<1	N/M	52	<1	33	N/M	N/M	<10	N/M	<10	N/M	N/M	N/M	<10	5
ME-4	N/M	<1	<1	N/M	43	<1	29	N/M	N/M	N/M	N/M	N/M	N/M	N/M	N/M	N/M	5
MW-8	N/M	8	<1	N/M	223	<1	4	20	N/M	<10	N/M	<10	N/M	N/M	N/M	<10	11
OL-1	N/M	<1	<1	N/M	<1	<1	<1	334	N/M	381	N/M	51	N/M	N/M	N/M	<10	16
MTW	N/M	<1	<1	N/M	<1	<1	<1	<10	N/M	<10	N/M	<10	N/M	N/M	N/M	<10	4
CTW	N/M	<1	<1	N/M	<1	<1	<1	<10	N/M	<10	N/M	<10	N/M	N/M	N/M	<10	1
GH	N/M	<1	<1	N/M	<1	3	6	<10	N/M	<10	N/M	<10	N/M	N/M	N/M	<10	29
PW-1	N/M	<1	<1	N/M	<1	1	12	N/M	N/M	N/M	N/M	N/M	N/M	N/M	N/M	N/M	21
OLSE	N/M	5375	<1	N/M	22	5	18	17	N/M	<10	N/M	<10	N/M	N/M	N/M	<10	59
OLSW	N/M	<1	<1	N/M	<1	2	<1	<10	N/M	<10	N/M	<10	N/M	N/M	N/M	<10	17
3/16 BLANK	N/M	N/M	N/M	N/M	N/M	N/M	N/M	<10	N/M	<10	N/M	<10	N/M	N/M	N/M	<10	
LAB BLANK	N/M	<1	<1	N/M	<1	<1	<1	<10	N/M	<10	N/M	<10	N/M	N/M	N/M	<10	<1
LAB REF	N/M	<1	<1	N/M	<1	<1	<1	<10	N/M	<10	N/M	<10	N/M	N/M	N/M	10	5

Notes: MTW - Mobile Town Water
CTW, TPA, CTWA, CTWB - McIntosh Town Water
GH-2 Guest House
PW-1 CIBA - Geigy Purchase Water
OSLE - Old Landfill Seep East
OSLW - Old Landfill Seep West
All Concentrations in ppb
Samples Collected on March 15 and 16, 1982
Analyses by Environmental Protection Systems, Inc.; Jackson, Mississippi

SUMMARY OF WATER-QUALITY ANALYSES FROM SELECTED MONITOR WELLS, AUGUST, 1982

Well	1,1 DICHLOROETHYLENE	CHLOROFORM	CARBON TETRACHLORIDE	TRICHLOROETHENE	CHLOROBENZENE	1,1,1-TRICHLOROETHANE	TOLUENE	1,2-DICHLOROBENZENE	1,4-DICHLOROBENZENE	1,3-DICHLOROBENZENE	1,2,3-TRICHLOROBENZENE	1,2,4-TRICHLOROBENZENE	1,2,4,5-TETRACHLOROBENZENE	1,2,3,4-TETRACHLOROBENZENE	PENTACHLOROBENZENE	HEXACHLOROBENZENE	BENZENE	pH	SPECIFIC CONDUCTANCE
MW 0	N/D	1312	5	12	153	<1	12	[illegible]	46	N/D	N/D	N/D	N/D	[illegible]	10	N/D	27	6.0	[illegible]
MW 1CR	N/D	225	<1	<1	45	5	12	<10	10	N/D	N/D	N/D	N/D	N/D	<10	N/D	4	7.6	1909
MW-3	N/D	N/D	N/D	3	N/D	N/D	<1	N/D	<10	N/D	N/D	N/D	N/D	N/D	N/D	<10	1	4.9	[illegible]
PE-1	N/D	21	N/D	9	9	N/D	17	<10	<10	N/D	N/D	N/D	N/D	N/D	N/D	<10	2	4.5	N/D
PE-2	N/D	14	5	6	N/D	3	1	<10	<10	N/D	N/D	N/D	N/D	N/D	<10	N/D	7	4.5	[illegible]
PE-3	N/D	12	N/D	1	3	<1	12	<10	10	N/D	N/D	N/D	N/D	N/D	<10	N/D	2	5.4	N/D
LP-1	N/D	445	21	N/D	200	N/D	2	N/D	<10	N/D	N/D	N/D	N/D	N/D	N/D	<10	95	7	2600
LP-2	N/D	25	<1	2	N/D	<1	1	N/D	<10	N/D	N/D	N/D	N/D	N/D	<10	N/D	3	7.2	[illegible]
LP-3	N/D	18	7	7	6	4	13	N/D	<10	N/D	N/D	N/D	N/D	N/D	N/D	<10	15	N/D	[illegible]
LP-4	N/D	770	53	7	399	3	<1	2021	2769	N/D	11	212	11	182	<10	N/D	1118	6	840
LP-4	N/D	893	60	10	6502	3	16	2410	3102	N/D	17	232	15	199	<10	N/D	1628	6	[illegible]
ME-1	N/D	N/D	N/D	2	2	N/D	2	N/D	13	N/D	N/D	N/D	N/D	N/D	N/D	<10	2	7.1	[illegible]
ME-2	5	3	N/D	21	2	N/D	10	<10	<10	N/D	N/D	N/D	N/D	N/D	N/D	<10	3	5.5	[illegible]
ME-3	N/D	1075	6	12	1120	<1	7	N/D	193	N/D	N/D	<10	N/D	11	<10	N/D	240	5.7	1900
ME-4	N/D	N/D	N/D	1	<1	N/D	2	N/D	<10	N/D	N/D	N/D	N/D	N/D	N/D	N/D	2	4.1	[illegible]
✓MW-8	N/D	6	N/D	8	35	N/D	2	<10	<10	N/D	N/D	N/D	N/D	N/D	N/D	<10	4	5.5	270
MP-1	N/D	N/D	1	N/D	75	N/D	15	N/D	<10	N/D	N/D	N/D	N/D	N/D	N/D	N/D	4	6.5	3260
MP-2	N/D	N/D	<1	3	1	N/D	6	N/D	<10	N/D	N/D	N/D	N/D	N/D	N/D	<10	2	N/D	N/D
MP-3	N/D	103	2	N/D	23	<1	10	1047	1156	N/D	N/D	<10	N/D	N/D	<10	N/D	5	6	1459
MP-4	N/D	1221	8	5	2	<1	3	N/D	113	<10	N/D	N/D	N/D	N/D	<10	N/D	3	3.6	7560
MP-5	N/D	804	7	10	<1	N/D	3	N/D	83	<10	N/D	N/D	N/D	10	<10	<16	5	6.1	2150
MP-6	N/D	704	8	6	23	9	6	129	673	N/D	<10	24	N/D	39	<10	N/D	413	6.3	7500
MP-7	N/D	2213	13	13	1130	<1	9	371	400	N/D	N/D	11	<10	15	<10	N/D	440	11	4230
MP-7	N/D	2240	12	13	1106	<1	6	341	385	N/D	N/D	11	N/D	22	<10	N/D	670	11	4200
MP-8	N/D	26	N/D	14	697	N/D	13	191	175	N/D	N/D	<10	N/D	N/D	<10	N/D	37	12.2	N/D
MP-9	N/D	1036	9	10	3967	<1	15	702	750	N/D	N/D	<10	N/D	N/D	N/D	N/D	425	7.0	2230
MP 10	N/D	507	N/D	N/D	N/D	N/D	N/D	791	960	N/D	N/D	44	N/D	25	N/D	N/D	N/D	10.8	12500
MP-12	N/D	N/D	N/D	4	N/D	<1	2	N/D	<10	N/D	N/D	N/D	N/D	N/D	N/D	N/D	2	7.5	[illegible]
MP-13	[illegible]	2679	39	25	N/D	<1	N/D	815	1170	N/D	<10	25	N/D	45	<10	N/D	N/D	4	[illegible]
WP 1	N/D	9	4	4	2	2	1	N/D	<10	N/D	10	N/D	N/D	[illegible]	<10	<10	<19	5.0	[illegible]
WP 2A	N/D	N/D	N/D	3	9	N/D	4	25	40	N/D	N/D	N/D	N/D	N/D	N/D	<10	92	7.2	[illegible]
WP-3	13	377	N/D	12	10	N/D	6	<10	<10	N/D	N/D	N/D	N/D	N/D	N/D	N/D	5	4.8	[illegible]
WP 4	N/D	12	N/D	6	N/D	N/D	2	<10	10	N/D	N/D	N/D	N/D	N/D	N/D	N/D	2	6.4	[illegible]
WP 5	N/D	N/D	N/D	10	N/D	N/D	3	N/D	10	N/D	N/D	N/D	N/D	N/D	N/D	N/D	2	5.1	[illegible]
WP-6A	N/D	2210	N/D	9	N/D	<1	<1	396	491	N/D	N/D	11	N/D	N/D	N/D	N/D	502	4.4	[illegible]
WP-7A	N/D	3	N/D	11	1	1	3	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	5	7.6	[illegible]
WP-8	N/D	N/D	N/D	N/D	N/D	3	2	N/D	<10	N/D	N/D	N/D	N/D	N/D	N/D	N/D	2	7.7	[illegible]
WP-9A	N/D	17	N/D	8	1	N/D	7	N/D	<10	N/D	N/D	N/D	N/D	N/D	N/D	<10	2	5	[illegible]
WP-10A	N/D	3	N/D	12	32	N/D	11	N/D	31	N/D	N/D	N/D	N/D	N/D	N/D	N/D	3	11.0	5330
E-1	N/D	37	N/D	5	1	N/D	9	<10	<10	N/D	N/D	N/D	N/D	N/D	N/D	<10	3	7.4	[illegible]
E-2	N/D	12	N/D	7	N/D	N/D	3	N/D	<10	N/D	N/D	N/D	N/D	N/D	N/D	<10	2	7.3	[illegible]
E-3	4	3	N/D	8	N/D	N/D	2	147	106	N/D	N/D	N/D	N/D	N/D	<10	N/D	2	7.6	300
E-4	N/D	511	N/D	7	2	N/D	2	<10	<10	N/D	N/D	N/D	N/D	N/D	<10	N/D	3	4.2	8350
E-5	N/D	1449	37	12	94	N/D	4	13	19	N/D	N/D	N/D	N/D	N/D	N/D	N/D	34	4.2	[illegible]
E-6	N/D	223	N/D	7	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	4	5.7	1200
E-6	N/D	223	N/D	1	N/D	N/D	N/D	N/D	23	N/D	N/D	N/D	N/D	N/D	N/D	N/D	3	5.7	1200
DW-1	N/D	3	N/D	9	N/D	N/D	6	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	4	11.5	17500
DW-2	N/D	8	N/D	9	2	N/D	N/D	11	43	N/D	N/D	N/D	N/D	N/D	N/D	N/D	3	11.9	2200
DW-3	N/D	3	N/D	8	7	N/D	2	N/D	30	N/D	N/D	N/D	N/D	N/D	N/D	N/D	7	10.1	[illegible]
EPS BLANK 4011n20	N/D	9	2	N/D	<1	<1	3	N/D	N/D	N/A	N/A	N/D	N/A	N/A	N/A	N/A	3	N/A	N/A
EPS BLANK 4011n20	N/D	<1	N/D	N/D	N/D	N/D	1	N/D	N/D	N/A	N/A	N/D	N/A	N/A	N/D	N/A	1	N/A	N/A
EPS BLANK 4011n20	N/D	5	N/D	N/D	N/D	N/D	4	N/D	N/D	N/A	N/A	N/D	N/A	N/D	N/A	N/A	3	N/A	N/A
DI [illegible]	N/D	4	N/D	15	N/D	N/D	4	24	41	N/D	N/D	N/D	N/D	N/D	N/D	<10	16	N/A	N/A

NOTE: N/A - Not Measured
N/D - Not Detectable by Test
All concentrations in [illegible]
pH - Standard Units
Specific Conductance - umhos/cm

Organic Analyses Performed by:
Environmental Protection Systems Inc.
Jackson, Mississippi

Other Analyses by:
Olin Chemicals Group

Chart Prepared by: Everett [illegible]
Checked by: G.N. Richardson

38

0055

EPA SPLIT SAMPLE ANALYSIS
AUGUST 1982

TABLE 1
CYANIDE AND METALS DETECTED (ug/l)
GROUNDWATER MONITORING WELLS
OLIN AND CIBA GEIGY CORPORATIONS
MCINTOSH, ALABAMA
AUGUST 1982

	OLIN ZONE I WELLS											
	OC-E1	OC-E2	OC-WP12	OC-WP12D	OC-WP4	OC-WP40	OC-WP4A	OC-WP9	OC-PE2	OC-PE3	[illegible]	[illegible]
Chromium	17	—	36	52	58	27	—	16	—	—	14	—
Lead	48	88	88	100	100	100	59	100	69	97	250	5
Zinc	30	32	—	81	85	120	—	28	14	36	310	—
Aluminum	3,000	680	5,600	8,300	15,000	8,500	—	5,700	680	4,000	17,000	300
Manganese	35	23	76	220	140	86	21	96	67	—	88	21
Calcium	—	—	—	—	—	—	—	—	—	—	—	—
Iron	1,600	1,400	3,700	6,900	39,000	23,000	1,500	9,000	1,500	2,000	52,000	320
Magnesium	—	—	—	—	—	—	—	—	—	—	—	—
Cadmium	—	—	5	6	—	—	—	—	—	—	—	—
Sodium	—	—	—	—	—	—	—	—	—	—	—	—
Beryllium	—	—	—	10	—	—	—	—	—	—	—	—
Arsenic	—	—	—	—	—	—	—	—	—	—	60	—
Barium	—	—	—	—	—	—	—	150	280	—	540	—
Cobalt	—	—	—	—	—	—	—	—	—	—	—	—
Copper	—	—	—	—	—	—	—	—	—	—	—	—
Nickel	—	—	—	—	60	—	—	—	—	130	90	—
Mercury	—	—	—	—	—	—	—	—	—	—	0.33	—
Tin	—	—	—	—	—	—	—	—	—	—	35	—
Selenium	—	—	—	—	—	—	—	—	—	—	—	—
Silver	—	—	—	—	—	—	—	—	—	—	—	—
Strontium	—	—	—	—	—	—	—	—	—	—	—	—
Titanium	—	—	—	—	—	—	—	—	—	—	—	—
Yttrium	—	—	—	—	—	—	—	—	—	—	—	—
Cyanide	—	—	—	—	—	—	—	—	—	—	—	—

	OLIN ZONE II WELLS							CIBA GEIGY
	OC-WE3	OC-LP1	OC-8RB	OC-8RBD	OC-WP3	OC-LP4	OC-OL1	CG-E1
Chromium	—	290	—	—	43	—	120	—
Lead	90	220	350	380	760	64	130	—
Zinc	450	950	680	890	690	230	430	22
Aluminum	3,500	61,000	120,000	120,000	32,000	7,700	220,000	170
Manganese	820	2,500	1,600	1,600	2,300	2,100	1,000	170
Calcium	—	—	—	—	—	—	—	2,900
Iron	1,700	60,000	370	8,300	9,000	5,700	68,000	70
Magnesium	—	—	—	—	—	—	—	1,800
Cadmium	12	10	20	25	170	—	7	—
Sodium	—	—	—	—	—	—	—	6,200
Beryllium	22	—	38	45	62	12	—	—
Arsenic	—	43	37	34	—	—	40	—
Barium	250	600	130	180	—	—	—	98
Cobalt	180	360	450	580	860	380	—	16
Copper	120	88	62	77	86	—	320	5
Nickel	220	180	290	340	820	110	160	9
Mercury	0.31	0.6	11	10	5.4	4.7	7.6	1.3
Tin	22	—	280	130	7,600	—	79	—
Selenium	—	—	—	3	4	—	—	—
Silver	—	—	—	—	48	—	—	—
Strontium	—	—	—	—	—	—	—	[illegible]
Titanium	—	—	—	—	—	—	—	[illegible]
Yttrium	—	—	—	—	—	—	—	[illegible]
Cyanide	—	—	—	—	—	—	—	[illegible]

COMMENTS: (—) - A dash in the table indicates that the compound/element was analyzed for but was not detected at or above the minimum quantifiable limit (MQL). The MQL's vary from sample to sample and from parameter to parameter; see analytical data sheets (Appendix A) for exact values.

TABLE 2
ORGANIC COMPOUNDS DETECTED (ug/l)
GROUNDWATER MONITORING WELLS
OLIN AND CIBA GEIGY CORPORATIONS
MCINTOSH, ALABAMA
AUGUST 1982

	OLIN ZONE I WELLS										
	OC-E1	OC-E2	OC-MP12	OC-MP12D	OC-MP6	OC-MP4D	OC-MW6	OC-MW9	OC-PE2	OC-MW3	OC--
Extractable Organics											
1,4-Dichlorobenzene	—	<10	<10	—	19	—	—	—	—	—	—
Phenol	—	14J	—	20J	—	—	—	—	—	—	—
Di-n-butylphthalate	—	—	60	—	—	—	—	—	—	—	—
Bis (2-ethylhexyl) phthalate	—	—	11	—	—	<10	—	—	—	<10	<1
Di-n-octylphthalate	—	—	<10	—	—	—	—	—	—	—	—
2,4-Dichlorophenol	—	—	—	—	—	—	—	—	—	—	—
1,3-Dichlorobenzene	—	—	—	—	—	—	—	—	—	—	—
1,2-Dichlorobenzene	—	—	—	—	18	—	—	—	—	—	—
1,2,4-Trichlorobenzene	—	—	—	—	—	—	—	—	—	—	—
Hexachlorobenzene (HCB)	—	—	—	—	—	—	—	—	—	—	—
2-Chlorophenol	—	—	—	—	—	—	—	—	—	—	—
Naphthalene	—	—	—	—	—	—	—	—	—	—	—
Acenaphthene	—	—	—	—	—	—	—	—	—	—	—
Fluorene	—	—	—	—	—	—	—	—	—	—	—
Phenanthrene	—	—	—	—	—	—	—	—	—	—	—
Anthracene	—	—	—	—	—	—	—	—	—	—	—
Fluoranthene	—	—	—	—	—	—	—	—	—	—	—
Pesticides/PCB's											
Alpha-BHC	—	—	—	—	—	—	—	—	—	—	—
Beta-BHC	—	—	—	—	—	—	—	—	—	—	—
Gamma-BHC (lindane)	—	—	—	—	—	—	—	—	—	0.2	—
Delta (BHC)	—	—	—	—	—	—	—	—	—	—	—
Purgeable Organics											
1,1-Dichloroethene	—	—	—	—	—	—	—	—	—	—	—
1,1-Dichloroethane	—	—	—	—	—	—	—	—	<10	—	—
Trans-1,2-Dichloroethene	—	—	—	—	—	—	—	—	—	—	—
Chloroform	<10	<10	—	—	<10	<10	—	<10	<10	<10	<1
1,1,1-Trichloroethane	—	—	—	—	—	—	—	—	<10	—	—
Carbon tetrachloride	—	—	—	—	—	—	—	17	<10	—	—
Bromodichloromethane	—	—	—	—	—	—	—	—	—	—	—
Trichloroethene	—	—	—	—	—	—	—	—	—	—	—
Benzene	—	—	—	—	—	—	—	—	—	—	—
Tetrachloroethene	—	—	—	—	—	—	—	—	—	—	—
Chlorobenzene	<10	—	—	—	15	—	13	—	<10	<10	—
Acrylonitrile	<100	—	—	—	—	—	<100	<100	—	<100	—
Toluene	23	—	—	—	—	—	—	—	—	—	—
Ethyl Benzene	<10	—	—	—	—	<10	—	<10	—	<10	—
Methylene Chloride	—	—	—	39	—	—	—	—	—	—	—
Bromoform	—	—	—	—	—	—	—	—	—	—	—
Dibromochloromethane	—	—	—	—	—	—	—	—	—	—	—
1,2-Dichloroethane	—	—	—	—	—	—	—	—	—	—	—
Miscellaneous Analysis											
Propazine	—	—	—	—	—	—	—	—	—	—	—
Prometryn	—	—	—	—	—	—	—	—	—	—	—
Chlorocyclohexane	N	—	—	—	—	—	—	—	—	—	—
Bicyclohexyl	—	N	N	—	—	N	—	N	—	—	—
Petroleum Product	—	—	—	N	—	—	—	—	—	—	—
Tetrachlorobenzene	—	—	—	—	—	—	—	—	—	—	—
Pentachlorobenzene	—	—	—	—	—	—	—	—	—	—	—
Trichlorobenzene (Not 1,2,4)	—	—	—	—	—	—	—	—	—	—	—
Fluorobiphenyl	—	—	—	—	—	—	—	—	—	—	—
Pentachloronitrobenzene	—	—	—	—	—	—	—	—	—	—	—
Bromobenzene	—	—	—	—	—	—	—	—	—	—	—
Thiobishenzene	—	—	—	—	—	—	—	—	—	—	—
Trichloropropane	—	—	—	—	—	—	—	—	—	—	—
Dichlorocyclohexane	—	—	—	—	—	—	—	—	—	—	—
Unidentified compound(s)	—	3	1	2	2	—	1	1	3	2	—

NOTATIONS: (-) - A dash in the table indicates that the compound/element was analyzed for but was not detected at or above the minimum quantitiable limit (MQL). The MQL's vary from sample to sample and from parameter to parameter; see analytical data sheets (Appendix A) for exact values.
(<) - Less than MQL.
J - Estimated value.
N - Presumptive evidence of presence of material.

TABLE 2 (CONTINUED)

	ZONE I WELL	OLIN ZONE II WELLS						CIBA
	OC-WE4	OC-WE3	OC-LP1	OC-ARM	OC-ARBD	OC-WP3	OC-LP2	OC-WL1	OC-
Extractable Organics									
1,4-Dichlorobenzene	—	430	—	91	130	<10	6,600	160	—
Phenol	—	—	—	—	—	—	21J	<25	—
Di-n-butylphthalate	—	<10	—	250	—	<10	—	<10	—
Bis (2-ethylhexyl) phthalate	—	<10	<10	<10	<10	<10	26	<10	—
Di-n-octylphthalate	—	—	—	<10	<10	—	—	—	—
2,4-Dichlorophenol	—	—	13J	—	—	—	87	<25	—
1,3-Dichlorobenzene	—	<10	—	—	<10	—	350	10	—
1,2-Dichlorobenzene	—	180	—	75	110	<10	5,800	250	—
1,2,4-Trichlorobenzene	—	24	—	—	—	—	790	120	—
Hexachlorobenzene (HCB)	—	—	—	—	—	—	12	36	—
2-Chlorophenol	—	—	—	—	—	—	120	<25	—
Naphthalene	—	—	—	—	—	—	—	200	—
Acenaphthene	—	—	—	—	—	—	—	11	—
Fluorene	—	—	—	—	—	—	—	<10	—
Phenanthrene	—	—	—	—	—	—	—	10J	—
Anthracene	—	—	—	—	—	—	—	10J	—
Fluoranthene	—	—	—	—	—	—	—	<10	—
Pesticides/PCB's									
Alpha-BHC	—	1.8N	—	0.8	3.2	—	50	—	—
Beta-BHC	—	—	1.9	—	—	—	—	65	—
Gamma-BHC (Lindane)	—	2.5N	0.7N	2.4	5.0N	—	50	37	—
Delta (BHC)	—	0.2	0.5	0.2N	1.3N	—	<5	6.5	—
Purgeable Organics									
1,1-Dichloroethene	—	—	—	—	<10	<10	<10	<10	—
1,1-Dichloroethane	—	—	—	<10	<10	<10	<10	—	—
Trans-1,2-Dichloroethene	—	—	—	—	—	<10	—	—	—
Chloroform	—	320	130J	470	420	130	250	16,000	1
1,1,1-Trichloroethane	—	—	—	—	—	—	<10	18	—
Carbon tetrachloride	—	<10	10J	<10	<10	—	<10	<10	—
Bromodichloromethane	—	<10	10J	<10	<10	<10	<10	<10	—
Trichloroethene	—	<10	—	<10	—	<10	<10	<10	—
Benzene	—	52	26	11	—	—	450	190	—
Tetrachloroethene	—	<10	—	—	<10	<10	<10	<10	—
Chlorobenzene	<10	580	480	49	42	<10	8,800	160	3
Acrylonitrile	<100	—	—	—	—	—	—	—	—
Toluene	—	—	—	—	—	—	—	—	—
Ethyl Benzene	—	—	—	<10	—	—	—	—	—
Methylene Chloride	—	—	—	—	—	—	—	200	—
Bromoform	—	<10	—	—	—	—	—	—	—
Dibromochloromethane	—	—	—	<10	<10	<10	—	—	—
1,2-Dichloroethane	—	—	—	—	—	—	—	<10	—
Miscellaneous Analysis									
Propazine	—	—	—	—	—	—	—	—	10.
Prometryn	—	—	—	—	—	—	—	—	10.
Chlorocyclohexane	—	—	—	—	—	—	—	—	—
Bicyclohexyl	—	—	—	—	—	—	—	—	—
Petroleum Product	—	—	—	—	N	—	—	N	—
Tetrachlorobenzene	—	N	—	—	N	—	N	N	—
Pentachlorobenzene	—	—	—	N	N	—	N	N	—
Trichlorobenzene (Not 1,2,4)	—	—	—	—	N	—	N	N	—
Fluorobiphenyl	—	—	—	—	N	—	N	—	—
Pentachloronitrobenzene	—	—	—	—	—	—	N	—	—
Bromobenzene	—	—	—	—	—	—	N	—	—
Thiophisbenzene	—	—	—	—	—	—	—	N	—
Trichloropropane	—	—	—	—	—	—	—	N	—
Dichlorocyclohexane	—	—	—	—	—	—	—	N	—
Unidentified compound(s)	4	2	2	4	4	2	2	4	—

NOTATIONS: (—) - A dash in the table indicates that the compound/element was analyzed for but was not detected at or above the minimum quantifiable limit (MQL). The MQL's vary from sample to sample and from parameter to parameter; see analytical data sheets (Appendix A) for exact values.
(<) - Less than MQL.
J - Estimated value.
N - Presumptive evidence of presence of material.

TABLE 3
SUPERFUND NOTIFICATION OF ON-SITE HAZARDOUS MATERIALS
OLIN CORPORATION
MCINTOSH, ALABAMA
JUNE 1981

Well Olin	Mercury (RCRA No. U009)	Hexachlorobenzene (RCRA No. U127)	Chlorobenzene (RCRA No. U037)	1,2-Dichlorobenzene (RCRA No. U070)	1,3-Dichlorobenzene (RCRA No. U071)	Pentachloronitrobenzene (RCRA No. U185)
OC-4A	--	--	<10	--	--	--
OC-12	--	--	--	--	--	--
OC-MW12	--	--	--	--	--	--
OC-MW12D	--	--	--	--	--	--
OC-1P1	0.6	--	480	--	--	--
OC-6A4	--	--	<10	--	--	--
OC-6W8	--	--	13	--	--	--
OC-6P9	--	--	--	--	--	--
OC-9A2	--	--	<10	--	--	--
OC-11A3	--	--	<10	--	--	--
OC-11W3D	0.33	--	--	--	--	--
OC-6E3	0.31	--	580	180	<10	--
OC-6P4	--	--	15	18	--	---
OC-6A4D	--	--	--	--	--	--
OC-8E8	11	--	49	75	--	--
OC-8W8D	10	--	42	110	<10	--
OC-9P3	5.4	--	<10	<10	--	--
OC-LP4	4.7	12	8,800	5,800	350	N
OC-OL1	7.6	36	160	250	10	--
Ciba-Geigy						
CG-001	1.0	--	3J	--	--	--

Notes:
1. The compounds listed on this table are those that Olin Corporation had included in written response (US-EPA Form 8900-1) to EPA as required by Section (C) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA; Superfund). Each compound is listed under Section 3001 of the Resources Conservation and Recovery Act (RCRA). Not included on the table is RCRA Number K085 (distillation or fractionation column bottoms from the production of chlorobenzenes) which includes dichlorobenzenes through hexachlorobenzenes, benzyl chloride, benzene, and monochlorobenzene. See the attached tables and data sheets for a complete list of chlorinated benzene compounds and other organic compounds detected.
2. J -- Estimated value.
3. N -- Presumptive evidence of presence of material.

TABLE 4
FIELD MEASUREMENTS/SAMPLE METHODOLOGY
GROUNDWATER MONITORING WELLS
OLIN CORPORATION
MCINTOSH, ALABAMA
AUGUST 1982

Well	Sample Date/Time	pH*	Temperature* (°C)	Conductivity* (umhos/cm)	Sample Methodology
Olin Corporation					
OC-E1	8/2/82 1545	7.4	22	360	Split[1]
OC-E2	8/2/82 1645	7.3	27	80	Split[1]
OC-MP12	8/3/82 1140	7.5	26	280	Split[1]
(OC-MP12D)	8/3/82 1215				Additional sample from well OC-MP12 (US-EPA only)[2]
OC-LP1	8/3/82 1445	7.0	26	2,100	Split[1]
OC-WE4	8/3/82 1620	4.1	--	43	Split[1]
OC-WW8	8/4/82 0835	5.5	21	370	Split[1]
OC-WP9	8/4/82 1000	5.0	21	70	Split[1]
OC-PE2	8/4/82 1220	4.5	23	130	Split[1]
OC-PM3	8/4/82 1100	4.0	22	90	Split[1]
(OC-PM3D)	8/4/82 1130				Additional sample from well OC-PM3 (US-EPA only)[2]
OC-WE3	8/4/82 1345	3.7	23	4,900	Split[1]
OC-WP4	8/5/82 1010	6.4	23	150	Split[1]
(OC-WP4D)	8/5/82 1040				Additional sample from well OC-WP4 (US-EPA only)[2]
OC-BR8	8/5/82 0930	6.7	29	1,400	Split[1]
(OC-BR8D)	8/5/82 0950				Additional sample from well OC-BR8 (US-EPA only)[2]
OC-WP3	8/5/82 1340	4.8	--	1,650	Split[1]
OC-LP4	8/5/82 1500	6.0	--	800	Split[3]
OC-OL1	8/5/82 1550	2.6	25	4,100	Sample collected by US-EPA only
Ciba-Geigy					
CG-001	8/2/82 1100	7.1	--	--	Sample collected by US-EPA -- Split between Ciba-Geigy and US-EPA

Footnotes:

-- Not available.
* Measurements made by US-EPA personnel using US-EPA equipment.
1. Well evacuated by Olin personnel via bladder pump; sample split between Olin and US-EPA.
2. The bladder pump used by Olin Corporation to collect monitoring well samples did not comply with US-EPA sampling protocol. Therefore, an additional sample from the same well was collected by US-EPA personnel, via stainless steel bailer, for analytical comparison between the two methods (see reference 4).
3. Sample collected by US-EPA personnel via US-EPA stainless steel bailer; sample split between Olin and US-EPA.

SEDIMENT AND PESTICIDE ANALYSIS OF OLIN EFFLUENT AND DISCHARGE CANAL

TABLE WQ-10

SEDIMENT AND PESTICIDE ANALYSES OF
OLIN EFFLUENT AND DISCHARGE CANAL

Bottom Sediment Analysis*

Constituent	Effluent Sediment	Olin Canal Sediment
Iron as Fe	14 mg/g	24 mg/g
Total Mercury as Hg	4.6 ug/g	9.3 ug/g
Organic Content (Volatile Matter @ 550°C)	0.87%	6.96%
Moisture Content	63%	148%

Organochlorine Pesticides

	Effluent Water (ug/l)	Olin Canal Water (ug/l)	Effluent Sediment (ug/g)	Olin Canal Sediment (ug/g)
BHC	<.1	0.6	<.01	<.01
Lindane	0.4	0.6	0.32	0.02
Heptachlor	<.1	<.1	<.01	<.01
Aldrin	<.1	<.1	<.01	<.01
Endosulfan	<.1	0.4	0.11	0.10
DDE	<.1	<.1	0.02	0.15
Dieldrin	<.1	<.1	<.01	<.01
Endrin	<.1	<.1	<.01	0.03
DDD	<.1	<.1	0.03	0.15
DDT	<.1	<.1	0.03	0.25
Mirex	<.1	<.1	<.01	<.01
Methoxychlor	<.1	<.1	<.01	<.01

* Based on dry weight of sample

Source: Betz Environmental Engineers

APPENDIX D

SUMMARY OF WELL DATA

Summary of Hydrologic Data on Brine Wells and Deep Stratigraphic Test Holes

STATE: Alabama

SOIL & MATERIAL ENGINEERS WELL SUMMARY

COUNTY: Washington

SME JOB NO. [illegible]

SME Well No.	State Number	Latitude Longitude	Elevation (MSL)	Owner/Location	Use	Total Depth	Casing Dia.	Casing Depth	Date Comp.	Logs	Chemical Analyses	Order drilled	Remarks
NC 1				National Gypsum TH No. 1 E of salt dome	Test Abn.	365			1955	NA			No logs Smith & Oliver (1977) report no cap rock to TD
NC 2				National Gypsum TH No. 2 W Hwy 43 near guest house	Test Abn.	344			1955	NA			No logs Smith & Oliver (1977) report no cap rock to T.D.
TH A 1				Olin Test Hole A 1 SE side dome	Test Abn.	1926	16 SP 8 5/8	0 80 415	12/23 1976	D, Res, (D II S.P.) DC, LC (CDL) CAL, C (Dress, All			Justiss Mears Oil Co. rig Grimes. See Smith & Oliver(1977). NaCl = 1944 150 000 ppm. Plugged (1722 1822, 700 300 in csg, 315 515 in out SPI)
TH A 2				Olin Test Hole A 2 SE side dome	Test Abn.	3078	16 SP 8 5/8	0 80 898	1/24 1977	D CDL, CAL C, Vel. log (Res D [ ]			Justiss Mears Oil Co. rig Grimes See Smith & Oliver (1977) Penetrated caprock at 1746 ft. Out of salt at 2269, sd, slt, l.s. to TD Plugged (2150 2370, 850 970, 0 100)
JS 1				Olin Joy & Smith oriented core hole No. 1 NW BW 2	Test Abn.	+ 390			1967	NA			Top caprock 293, top salt 390
JS 2				Olin Joy & Smith oriented core hole No. 2 Near S entrance Rd	Test Abn	+ 400			1967	NA			Top caprock 361, top salt 400
HD 1				Humble Brykin No 1 Oil Test Well The "discovery well"	Test Abn	540			1948	NA			Smith & Oliver (1977) Top caprock 290 top salt 470 Salt dome discovery well
BA 1				Brine Well No 1	Abn brine	2591			1951	D,			A.W. Williams Rept (1951) Top Caprock 220 top salt [illegible]
BA 2				Brine Well No. 2	Abn. brine	2685	20 SP red to 5 1/2	0 60 2621	July 1951	D, C, CCL (SONIC)			See A.S. Williams Rept. S [illegible] Top caprock 1 285 top salt [illegible]
BA 3				Brine Well No. 3	Ind brine					None			No logs Smith & Oliver, 1977

[illegible] 3/[illegible]

STATE: Alabama

COUNTY: Washington

SOIL & MATERIAL ENGINEERS WELL SUMMARY

Atlanta [illegible] 077A

S&ME JOB NO. [illegible]

S&ME Well No.	State Number	Latitude / Longitude	Elevation (MSL)	Owner/Location	Well Use	Total Depth	Casing Dia.	Casing Depth	Pump Rate	Date Comp.	Logs	Chemical Analyses	Well Comp.	Remarks
BW 4				Brine Well No. 4	Ind. brine									No logs (Smith & Oliver 1971)
BW 5				Brine Well No. 5	Ind. brine									No logs (Smith & Oliver 1971)
BW 6				Brine Well No. 6	Ind. brine					1966				No logs, but see D log for JCH 1 Top caprock 290, Top salt 430
BW 7			48.76	Brine Well No. 7	Ind. brine	4500	10 SP reduced to 7	0 130 3815 8457		11/9 1976	D., C, N, CDL, CBL			Marion Drlg. Co Fenix & Scission drilling rept Top caprock 335, top salt 470
BW 8			41.19	Brine Well No. 8	Ind. brine	4500	10 SP reduced to 7	0 158		1/30 1977	D., GRTL CDL, G, C, CBL			Marion Drlg. Co Fenix & Scission drilling rept Top caprock 345, top salt 469
BW 9			42.51	Brine Well No. 9	Ind. brine	4525	10 SP reduced to 7	0 131 4450		3/25 1977	D CDL, G, C to 580 CDL, CBL to TD			Marion Drlg. Co Fenix & Scission drilling, rept Top caprock 343, top salt 414
JCH 1				Joy Core Hole S of BW 6	Test Abn	2505				1965	D			Top caprock 167, top salt 316
Abn 1				A.W. Williams Test Hole No. 1, near BW 2	Test Abn	2593	8 6	0 290 0 415		1/14 1953	D			Local approximate See A.W. Williams deed No. [illegible]

Summary of Hydrologic Data on Water Wells and Water Well Test Holes

SOIL & MATERIAL ENGINEERS WELL SUMMARY

[illegible] [illegible] Atlanta [illegible]

[illegible] Washington SAME JOB NO. [illegible]

SAME Ref. No.	State Number	Latitude Longitude	Elevation (MSL)	Owner/Location	Well Use	Total Depth	Casing Dia.	Casing Depth	Pump Rate	Date Comp.	Logs	Chemical Analyses	Well Cons.	Remarks
WW 1	AGS AA 4		43 ?	Olin Water Well No. 1	Abn. 1971	290	12	0 285		1951	D		NP	A. W. Williams Inspection Co. 12 in Scn. 2[illegible] [illegible] loss in 1[illegible] [illegible] Fe [illegible]
WW 2	AGS AA [illegible]		[illegible]	Olin Water Well No. 2	Abn. 1970 71	[illegible]50	12	0 [illegible]		1951	D G(SEME)		NP	A. W. Williams Inspection Co. Abnd. 1970 71. [illegible] 12 in Scn. 2[illegible] 245. No grout. [illegible]
WW 3	AGS AA 10		42	Olin Water Well No. 3	Ind.	240	12	0 200		1951	D		NP	A. W. Williams Inspection Co. 12 in Scn. 200 240. No probs [illegible] this well (J. Fleming)
WW 4	AGS AA 6		42	Olin Water Well No. 4 Well may have plugged Scn (J. Fleming)	Ind.	245	12	0 202		1951	D	Partial 1 76, 10/74 Olin W.S. 3 8 76	NP	A.W. Williams Inspection Co. 12 in Scn. 202 245. First 10 yrs [illegible] didn't use, had drilling mud in hole. No grout.
WW 5	AGS AA 9			Olin Water Well No. 5 (failed : 1979)	Unu	314	20 9 6 4	0 200 200 240 240		1951	No logs info. from ACS	Partial 1 76, 10/74 Olin W.S. 3 8 76	GP	J.Q. Peeples, replaced by WW No. 10. After failed, 6, 4 in Scn. liner installed inside original Scn. Sand problems originally.
WW 6	AGS AA 11		40	Olin Water Well No. 6	Unu (obs)	303	24 16 12	0 72.8 0 243 223 250.7		1957	C by SEME	Partial 1.76, 10/74 Olin W.S. 3 8 76	GP	J.Q. Peeples. 12 in Cook wire wound Scn 250.75 292. Replaced by WW No. 11. Still avail. but not used. For 4 6 yrs. sand problems & encrustation
WW 7			43	Olin Water Well No. 7	Ind.	250	20 12	0 170 120 180		1971	D	Partial 1 76, 10/74 Olin W.S. 3 8 76	GP	Carloss Well Supply Co. Rept. WW 2 12 in. st. stl., Carloss louver Scn. [illegible] 240 (from pre drill dwg... dtd. 3 12 71)
WW 8	(air line)		43	Olin Water Well No. 8	Ind.	340	20 12	0 199 1250 156.5	0 Test 1548 206.5	1972	D	Partial 1.76, 10/74 Olin W.S. 3 8 76	GP	Carloss Well Supply Co. 12 in st. stl., Carloss louver Scn. 206.5 266.5. 24 hr P test 10 19 72. S C. - 79.
WW 9	[illegible] (well)		45	Olin Water Well No. 9	Ind.	272.5	24 16	0 195 140 202 11/19/76	Test 1160	11.19 1976	D		GP	Carloss Well Supply Co. 16 in st. stl. Carloss louver Scn. 205.5 265.5. Sieve analyses (4) 183 275. 8 hr P test 11/19/76. S.C. 38.
WW 10			50	Olin Water Well No. 10	Ind.	343	24 10	0 245 150 255	Test 1200 3 16 79	Feb. 1979	D. SP. Res. C (ACS 2 16 79)			Griner Drilling Serv. 10 in H. Smith st. stl. Scn. 255 315. Sieve analyses (6) from 240 300. 8 hr P test, 3 16 79. S.C. = 24

SEME [illegible] (4/61)

38 0067

Summary of Well Construction Data on Olin Monitor Wells

SOIL & MATERIAL ENGINEERS WELL SUMMARY

Washington

SAME Well No	State Number	Latitude Longitude	Elevation (MSL)	Owner/Location	Well Use	Total Depth	Casing Dia.	Casing Depth	Pump Rate	Date Comp.	Logs	Chemical Analyses	Well Cons.	Remarks
BA-1			31	Olin Chemical		28	2" SCN	0-18 18-28			Gamma	[illegible] Labs		
BR-1			45	Olin Chemical		10	2" SCN	0-10				EPS Labs		
BR-2			45	Olin Chemical		33	2" SCN	0-23 23-33			Gamma	EPS Labs		
BR-3			44	Olin Chemical		14	2" SCN	0-4 4-14				EPS Labs		
BR-4			43	Olin Chemical		42	2" SCN	0-32 32-42			Gamma	EPS Labs		
BR-5			44	Olin Chemical		76.5	2" SCN	0-27 27-37		11-24-80	Drillers Gamma Geologist	EPS Labs		
BR-6R			44	Olin Chemical		36	2" SCN	0-26 26-36			Gamma	EPS Labs		G Log measured depth 35
BR-7R			43	Olin Chemical		51.5	2" SCN	0-26 26-36		12-19-80	Gamma	EPS Labs		
BR-8R			45	Olin Chemical		50	2" SCN	0-40 40-50			Gamma Drillers	EPS Labs		
BR-9R			44	Olin Chemical		41	2" SCN	0-21 21-41			Gamma	EPS Labs		G Log measured depth 27

Alabama

SOIL & MATERIAL ENGINEERS WELL SUMMARY

Washington

SAME Well No	State Number	Latitude Longitude	Elevation (MSL)	Owner/Location	Well Use	Total Depth	Casing Dia.	Casing Depth	Pump Rate	Date Comp.	Logs	Chemical Analyses	Well Cons	Remarks
BR-10R			45	Olin Chemical		48	2" SCH	0-28 28-48			Gamma	EPS Labs	MP	
FP-1R			41	Olin Chemical		43	2" SCH	0-23 23-43			Gamma	EPS Labs	MP	G Log measured depth 42
FP-2R			54	Olin Chemical		43	2" SCH	0-23 23-43			Gamma	EPS Labs	MP	G Log measured depth 27
FP-3R			53	Olin Chemical		46	2" SCH	0-26 26-46			Gamma	EPS Labs	MP	G Log measured depth 43
FP-4R			53	Olin Chemical		47	2" SCH	0-25 25-45				EPS Labs	MP	G Log measures depth 47
OL-1			39	Olin Chemical		41.5	2" SCH	0-18 18-28			Gamma Geologist	EPS Labs	MP	G Log measured depth 36

38 0069

SOIL & MATERIAL ENGINEERS WELL SUMMARY

S&ME Well No	State Number	Latitude Longitude	Elevation (MSL)	Owner/Location	Well Use	Total Depth	Casing Dia.	Casing Depth	Pump Rate	Date Comp	Logs	Chemical Analyses	Well Cons	Remarks
PE-1			46	Olin Chemical		38.0	2" SCH	0-25 25-35		1-19-81	Gamma Drillers	EPS Labs	NP	
PE-2			43	Olin Chemical		41.5	2" SCH	0-27 27-37		11-15-80	Gamma Geologist	EPS Labs	NP	G Log measured depth 37
PE-3			43	Olin Chemical		50	2" SCH	0-40 40-50			Gamma	EPS Labs	NP	
PE-4			46	Olin Chemical		49	2" SCH	0-29 29-49			Gamma	EPS Labs	NP	
PE-5			31	Olin Chemical		40	2" SCH	0-30 30-40		1-19-81	Drillers	EPS Labs	NP	
PE-6			45	Olin Chemical		32	2" SCH	0-22 22-32				EPS Labs	NP	G Log measured depth 27
PE-7			47	Olin Chemical		40	2" SCH	0-30 30-40			Gamma	EPS Labs	NP	G Log measured depth 40
PH-1			43	Olin Chemical		43	2" SCH	0-33 33-43			Gamma	EPS Labs	NP	G Log measured depth 43
PH-2			41	Olin Chemical		38	2" SCH	0-28 28-38		1-19-81	Gamma	EPS Labs	NP	G Log measured depth 38

SOIL & MATERIAL ENGINEERS WELL SUMMARY

S&ME well No	State Number	Latitude Longitude	Elevation (MSL)	Owner/Location	Well Use	Total Depth	Casing Dia.	Casing Depth	Pump Rate	Date Comp	Logs	Chemical Analyses	Well Conn	Remarks
PH-3			37	Olin Chemical		27	2" SCH	0-17 17-27			Gamma	EPS Labs	NP	
PH-4R			37	Olin Chemical		33	2" SCH	0-17 17-27		1-19-81	Gamma Drillers	EPS Labs	NP	
PH-5			38	Olin Chemical		41.5	2" SCH	0-29 29-39		12-18 80	Drillers Gamma	EPS Labs	NP	
PH-6R			42	Olin Chemical		47	2" SCH	0-27 27-47			Gamma	EPS Labs	NP	G Log measured depth 47
PH-7R			38	Olin Chemical		42	2" SCH	0-22 22-42			Gamma	EPS Labs	NP	G Log measured depth 42
PH-8R			40	Olin Chemical		40	2" SCH	0-20 20-40				EPS Labs	NP	G Log measured depth 40
SL-1			43	Olin Chemical		36.5	2" SCH	0-16 16-26		12-16 80	Drillers	EPS Labs	NP	
SL-2			42	Olin Chemical		42	2" SCH	0-32 32-42			Gamma Driller	EPS Labs	NP	

Alabama

SOIL & MATERIAL ENGINEERS WELL SUMMARY

Washington

Soil Well No	State Number	Latitude Longitude	Elevation (MSL)	Owner/Location	Well Use	Total Depth	Casing Dia	Casing Depth	Pump Rate	Date Comp	Logs	Chemical Analyses	Well Conn	Remarks
SI-3			42	Olin Chemical		17.5	2" SCH	0-7.5 7.5-17.5		1-19-81	Gamma Drillers	EPS Labs	NP	G Log measured depth 17.5
SI-4			46	Olin Chemical		40	2" SCH	0-30 30-40			Gamma	EPS Labs	NP	G Log measured depth 40
WI-1			51	Olin Chemical		61.5	2" SCH	0-47 47-57		11-18-80	Drillers Gamma Geologist	EPS Labs	NP	G Log measured depth 57
WI-2			50	Olin Chemical		61.5	2" SCH	0-40 40-50		12-12-80	Gamma Geologist	EPS Labs	NP	G Log measured depth 49
WI-3			51	Olin Chemical		61.5	2" SCH	0-47 47-57		12-15-80	Gamma Drillers	EPS Labs	NP	G Log measured depth 57
WI-4			46	Olin Chemical		61.5	2" SCH	0-41 41-51		12-15-80	Gamma Drillers	EPS Labs	NP	G Log measured depth 51

Alabama

[illegible]

SOIL & MATERIAL ENGINEERS WELL SUMMARY

[illegible]

SAME well No.	State Number	Latitude Longitude	Elevation (MSL)	Owner/Location	Well Use	Total Depth	Casing Dia.	Casing Depth	Pump Rate	Date Comp.	Logs	Chemical Analyses	Well Cons	Remarks
EP-1			46	Olin Chemical		43	2" SCH	0-29 29-39		1-19-82	Gamma Drillers	EPS Labs	NP	G Log measured depth 39
EP-2			44	Olin Chemical		48	2" SCH	0-30 30-40		1-19-82	Gamma Drillers	EPS Labs	NP	G Log measured depth 40
EP-			50	Olin Chemical		51	2" SCH	0-41 41-51			Gamma	EPS Labs	NP	G Log measured depth 51
EP-4			46	Olin Chemical		41.5	2" SCH	0-26.5 26.5-36.5		12-1-80	Gamma Geologist Drillers	EPS Labs	NP	G Log measured depth 36.5

[illegible]

3 8 0073

Summary of Well Construction Data on S&ME Monitor Wells

State Alabama

County Washington

SOIL & MATERIAL ENGINEERS WELL SUMMARY

S&ME JOB NO. 071-82-077-A

S&ME Well No	State Number	Latitude Longitude	Elevation (MSL)	Owner/Location	Well Use	Total Depth	Casing Dia.	Casing Depth	Pump Rate	Date Comp.	Logs	Chemical Analyses	Well Cons.	Remarks
MP-1			47.07		MON	50'	2" SCH	0-45 45-50		1982 5-15	Drillers Geologist Gamma SPL.SPN.	EPS Labs S&ME G.C. Scanon Water Sample	MP	Seal: 36-40, Grout to surface Sieve: 28.5-30, 43.5-45, 48.5-50 Slug Test: too fast to measure
MP-2			45.12		MON	50'	2" SCH	0-45 45-50		5-11	Drillers Geologist Gamma SPL.SPN.	6-24-82 EPS Labs	MP	Seal: 36-40, Grout to surface Sieve: 43.5-45, 48.5-50
MP-3			47.92		MON	51'	2" SCH	0-46 46-51		5-19	Drillers Gamma	EPS Labs	MP	Seal: 31-35, Grout to surface
MP-4			46.95		MON	50'	2" SCH	0-45 45-50		6-24	Drillers Geologist Gamma SPL.SPN.	EPS Labs	MP	Seal: 36-40, Grout to surface Sieve: 18.5-20, 28.5-30, 48.5-50 Slug Test; G.C. scan on SPL.SPN. samples Set screen by G.C. scan; Organic odor
MP-5			46.06		MON	45'	2" SCH	0-40 40-45		6-15	Drillers Geologist Gamma SPL.SPN.	EPS Labs	MP	Seals: 32-36 Grout to surface G.C. scan on SPL.SPN. samples SCH set by G.C. scan Strong organic odor throughout
MP-6			45.64		MON	50'	2" SCH	0-39 39-44		6-14	Drillers Geologist Gamma SPL.SPN.	EPS Labs	MP	Seal: 32-35, Grout to surface Slug Test Strong organic odor throughout
MP-7			46.58		MON	50'	2" SCH	0-43.6 43.8-48.5		6-22	Drillers Geologist Gamma SPL.SPN.	EPS Labs S&ME G.C. scan on Water Sample	MP	Seal: 20-25, (Caved @ 25'), Grout to surface Slug Test G.C. scan on samples SCH set by G. C. scan; organic odor
MP-8			45.66		MON	95'	6" 2" SCH	0-50 0-78.6 78.8-83.8		7-23	Geologist Gamma SPL.SPN.	6-25-82 EPS Labs	GP	Seal: 71-75, GP: 83.3-75, Grout to surface Organic odor @ water table and ended @ 70' in clayey silt zone Driller: Graves Well Drilling
MP-9			45.48		MON	60'	2" SCH	0-47 47-52		6-23	Drillers Geologist SPL.SPN.	EPS Labs	MP	Seal: 39-43, (caved @ 43') Grout to surface, sieve: 53.5-55, Slug test G.C. scan on SLP SPN. samples; Screen set by G.C Scan organic odor throughout
MP-10			46.33		MON	97'	6" 2" SCH	0-70 0-78 78-88		7-28	Geologist Gamma Mash Boring	EPS Labs		Seal: 73-75, (Bent & Secretel, GP: 75-88 Grout to surface, PD: 95-97 Driller: Graves Well Drilling

S&ME FORM H-03 (4/81)

STATE Alabama

SOIL & MATERIAL ENGINEERS WELL SUMMARY

COUNTY Washington

S&ME JOB NO. 071-82-077-A

S&ME Well No	State Number	Latitude Longitude	Elevation (MSL)	Owner/Location	Well Use	Total Depth	Casing Dia.	Casing Depth	Pump Rate	Date Comp	Logs	Chemical Analyses	Well Cons.	Remarks
MP-11			46.67		MON	45'	2" SCH	0-39 39-44		1982 6-2	Drillers Geologist SPL.SPN.	S&ME G.C. scan on Water Sample 6-25-82	GP	Seal: 32-36, (caved @ 39', GP to 36'), Grout Sieve: 23.5-25, 33.5-35, 43.5-45/to surface Slug Test. Drilling mud broke down because of high PH (well in old lime pond area)
														Organic smell @ water table. Well modified to shallow because of odor
MP-12			50.45		MON	80'	2" SCH	0-62 62-72		7-10	Drillers Geologist Gamma SPL.SPN.	EPS Labs	MP	Seal: 44-45 (Hole caved @ 45') Sieve: 23.5-25, 43.5-45, 48.5-50, 33.5-35, 58.5-60, 63.5-65, 68.5-70
MP-13			46.69		MON	100'	6" 2" SCH	0-70 0-85 85-95		7-29	Geologist Gamma Mash Boring	EPS Labs	MP	Seal: 79-81 (Bent & Sacrete), GP: 81-95, Grout to surface; Slug Test too fast to measure; Organic odor @ water table
MP-1			49.34		MON	50'	2" SCH	0-43.5 43.5-48.5		5-17	Drillers Gamma Auger Bor ng	EPS Labs	MP	Seal: 36-30, Grout to surface
MP-2A			50.74		MON	75'	2" SCH	0-85 57-67		7-8	Drillers Geologist Gamma SPL.SPN.	EPS Labs	MP	Seal: 15-20, Grout to surface Organic order @ water table
MP-3			50.84		MON	100'	2" SCH	0-85 85-95		5-12	Drillers Geologist Gamma SPL.SPN.	EPS Labs S&ME G.C. scan on Water Sample	MP	Seal: 60-65, Grout to surface Sieve: 23.5-25, 48.5-50, 87.5-90, Slug Test Augered to 65'. Mud rotary to TD Very high salt content
MP-4			52.41		MON	84	2" SCH	0-61.9 61.9-71.9		5-28	Drillers Geologist SPL.SPN.	6-25-82 EPS Labs	GD	Seal: 59-64, GP:65-71.9, Grout to surface Slug Test See Attachment
MP-5			52.30		MON	50'	2" SCH	0-45 45-50		5-28	See MP-4 log Auger Bor ng	EPS Labs	MP	Seal: 33-37, (Caved @ 37'), Grout to surface Slug Test

S&ME FORM H-03 (4/81)

SOIL & MATERIAL ENGINEERS WELL SUMMARY

Washington

SME JOB NO. 071-01-077-A

SME Well No	State Number	Latitude Longitude	Elevation (MSL)	Owner/Location	Well Use	Total Depth	Casing Dia	Casing Depth	Pump Rate	Date Comp	Logs	Chemical Analyses	Well Cons.	Remarks
MP-6'			52.0'		ABN	55'				1982	Wash Boring	EPS Labs		Because of circulation problems pulled off hole. Grouted hole up when could not get @ backup on hole. Moved 14 feet east
MP-6A			52.27		MON	80'	2" SCH	57.5 57.5-67.5		6-10	Driller Geologist Gamma SPL. SPN.	EPS Labs	MP	Seal: 30-34 (Caved @ 34'), Grout to surface Slug Test UD: 76-80 Organic odor @ water table
														Samples sent to SME Raleigh for G.C. & ID
MP-7			58.78		MON	89'	2" SCH	0-67 67-77		6-10	Driller Geologist SPL. SPN.	EPS Labs	GP	Seal: 58-62, GP: 62-77 Sieve: 21.5-25, 40.5-50, 71.5-75 UD 87-89; Lost 80% circulation @ 20'
														Lignite very hard 78.5-82 Well abandoned, grouted inside casing Moved 30 feet north
MP-7A			58.78		MON	80'	2" SCH	0-66 66-76		8-6	Gamma See MP-7 Wash Boring	EPS Labs	GP	Seal: 59-61 (Bent & Secreted), GP: 61-76 Grout to surface Driller: Graves Well Drilling
MP-8			55.89		MON	80'	2" SCH	0-65 65-75		7-13	Driller Geologist Gamma	EPS Labs	MP	Seal: 31-35, grout to surface grout @ 35'
MP-9						50'	2" SCH	0-43.5 43.5-45		6-20	Auger Boring	EPS Labs	MP	Seal: 24-28 (Caved @ 28'), Grout to surface Added by J. Brown, Olin staff Well abandoned and grouted Moved 15 feet west
MP-9A			45.19		MON	50'	2" SCH	0-43.5 43.5-48.5		7-7	Gamma Auger Boring	EPS Labs	MP	Seal: 24-28 (Caved @ 28') Grouted to surface
MP-10			53.35		MON	95'	2" SCH	0-76.8 76.8-86.8		6-28	Driller Geologist SPL. SPN	EPS Labs	MP	Seal: 68-72 (Caved @ 72'), Grout to surface Sieve: 61.5-65, 68.5-70 UD: 91-95; Lost circulation [illegible] to regain. Abandoned well and grouted. Moved 18' east

SME FORM H-03 (4/81)

STATE Alabama

COUNTY Washington

SOIL & MATERIAL ENGINEERS WELL SUMMARY

S&ME JOB NO. [illegible]

S&ME Well No.	State Number	Latitude Longitude	Elevation (MSL)	Owner/Location	Well Use	Total Depth	Casing Dia.	Casing Depth	Pump Rate	Date Comp.	Logs	Chemical Analyses	Well Cons.	Remarks
WP-10A			53.15		MON	83'	2" SCN	0-65.9 65.9-75.9		1982 8-7	Gamma See WP-10 Wash Boring	EPS Labs	GP	Seal: 56-59 (Bent & Sacrete), GP. 59-65 Grout to surface; Organic odor Driller: Graves Well Drilling
DH-1			50.69		MON	240'	6" 2" SCN	0-100 0-220 220-238		8-4	Drillers Geologist Gamma Wash Boring	EPS Labs	GP	Seal: 216-220, GP. 220-238, Grout to surface Well installed in lower (Miocene) aquifer Driller: Graves Well Drilling
DH-2			47.72		MON	185'	6" 2" SCN	0-90 0-162 162-182		8-10	Geologist Gamma Wash Boring	EPS Labs	GP	Seal: 154-148 (Bent & Sacrete), GP: 158-172 Grout to surface; UD 93-95 Organic odor in upper sand only screen in sand unit of Miocene clay
DH-3			57.15		MON	196'	6" 2" SCN	0-100 0-186 186-196		8-16	Geologist Gamma Wash Boring	EPS Labs	GP	Seal: 160-165 (Bent & Sacrete), GP. 196-165 Grout to surface; Slug Test too fast UD 104-105.5 Driller: Graves Well Drilling

S&ME FORM H-03 (4/81)

38 0077

STATE Alabama

COUNTY Washington

SOIL & MATERIAL ENGINEERS WELL SUMMARY

S&ME JOB NO. [illegible]-A

S&ME Well No	State Number	Latitude Longitude	Elevation (MSL)	Owner/Location	Well Use	Total Depth	Casing Dia.	Casing Depth	Pump Rate	Date Comp.	Logs	Chemical Analyses	Well Comp.	Remarks
E-1			46.34		MON	105	2" SCH	0-75 75-85		1982 5-31	Drillers Geologist Gamma SPL.SPN.	EPS Labs	GP	GP: 66-85, Seal: 58-66, Grout to surface Sieve: 78.5-80, Slug Test Gravel Zone: 61-87.5, Clay @ 87.5 Circulating problems in sand and gravel
E-2			46.51		MON	50	2" SCH	0-45 45-50		5-20	Driller Geologist SPL.SPN.	EPS Labs	MP	Seal: 33-37,(Caved @ 37') Sieve: 48.5-50, Slug Test
E-3			45.74		MON	48.5	2" SCH	0-43.5 43.5-48.5		6-25	Gamma Auger Boring	EPS Labs	MP	Seal: 34-38, Grout to surface (Caved @ 38')
E-4			37.22		MON	50	2" SCH	0-45 45-50		5-17	Drillers Geologist Gamma SPL.SPN.	EPS Labs	MP	Seal: 34-38, Grout to surface Sieve: 48.5-50, Slug Test Drilled with mud, designed as deep boring but because of strong organic odor, terminated @ 50'. Odor decreased with depth
E-5			38.23		MON	80	6" 2" SCH	0-60 0-65.2 65.2-75.2		8-12	Geologist Gamma Mash Boring	EPS Labs	GP	Seal: 60-62, GP: 62-75.2, Grout to surface Well 75' SW of original location. Lost 90% circulation 55-57. No odor during drilling, but water had organic smell when developed. Driller: Graves Well Drilling
E-6			45.45		MON	50	2" SCH	0-42.8 42.8-47.8		5-16	Gamma Auger Boring	EPS Labs S&ME G.C. Water Sample 6-24-82	MP	Seal: 24-28 (Caved @ 28'), Grout to surface

S&ME FORM H-03 (4/81)

O - OBSERVATION
M - MONITOR
P - PRODUCTION

SUMMARY OF WELLS

* TO TOP OF SCREEN

OLIN/McINTOSH

WELL NO.	SURFACE ELEV.	TOP OF SCREEN ELEV.	WELL DEPTH *	DIA. (IN.)	DATE COMPLETED	TOTAL LENGTH	TYPE	NOTES
PE-8	?		10	2	2/85	50		
PE-9	?		10	2	2/85	70		
PE-10	?		18	2	2/85	78		
PE-11	?		13	2	2/85	73		

O - OBSERVATION
M - MONITOR
P - PRODUCTION

SUMMARY OF WELLS

* TO TOP OF SCREEN

OLIN/McINTOSH

WELL NO.	SURFACE ELEV.	TOP OF SCREEN ELEV.	WELL DEPTH*	DIA. (IN.)	DATE COMPLETED	TOTAL LENGTH	TYPE	NOTES
PL-1	59.28	3.28	56	2	5/83	71	M	
PL-2S	51.73	16.73	35	2	5/83	50	M	
PL-3S	43.32	-1.68	45	2	5/83	60	M	
PL-3D	42.80	-21.20	64	2	5/83	79	M	
PL-4S	50.40	5.40	45	2	5/83	60	M	
PL-4D	49.89	-27.11	77	2	5/83	92	M	
PL-5S	45.75	14.75	31	2	5/83	51	M	
PL-5M	45.42	-16.58	62	2	5/83	77	M	
PL-5D	44.72	-34.28	79	2	5/83	99	M	
PL-6S	56.70	25.70	31	2	6/83	46	M	
PL-6M	56.95	1.95	55	2	6/83	70	M	
PL-6D	56.58	-16.42	73	2	6/83	88	M	
PL-7S	?		57	2	5/83	72	M	
PL-7M	50.37	-9.63	60	2	5/83	55	M	
PL-8S	?		27	4	2/85	47	M	
PL-8D	?		63	4	2/85	83	M	
PL-9S	?		20	4	2/85	40	M	
PL-9D	?		57	4	2/85	77	M	
PL-10S	?		18	4	2/85	38	M	
PL-10D	?		60	4	2/85	80	M	

APPENDIX E

- REMEDIAL APPROACHES
- REMEDIAL TECHNOLOGIES
- LEGAL REQUIREMENTS APPLICABLE TO SELECTED RESPONSE ACTIONS

REMEDIAL ACTION APPROACHES

Nature of Waste Material	Remedial Action Approaches
Surface Wastes Onsite	o Offsite disposal o Onsite or offsite treatment o Onsite fixation o Secure for temporary onsite storage o No action
Buried Wastes Onsite	o Removal and disposal offsite o Secure for temporary onsite storage o Onsite or offsite treatment o Encapsulation or isolation for permanent onsite disposal o Onsite fixation o No action
Contaminated Soils Onsite	o Removal and disposal offsite o Fixation onsite or offsite o Treatment onsite or offsite o Onsite encapsulation or isolation o No action
Contaminated Ground Water Onsite	o Onsite encapsulation or isolation o Ground water flow diversion o Pumpout and treatment o Combination of the above o No action
Contaminated Ground Water Offsite	o Encapsulation or isolation o Ground water flow diversion o Pumpout and treatment o Combination of the above o Alternative water supplies o No action

REMEDIAL TECHNOLOGIES

Air Pollution Controls

- o Capping
  - Synthetic membrances
  - Clay
  - Asphalt
  - Multimedia cap
  - Chemical sealants/stabilizers
- o Vapor Collection and Treatment
- o Dust Control Measures

Surface Water Controls

- o Capping (See A.)
- o Grading
  - Scarification
  - Tracking
  - Contour furrowing
- o Revegetation
  - Grasses
  - Legumes
  - Shrubs
  - Trees, conifers
  - Trees, hardwoods
- o Diversion and Collection Systems
  - Dikes and berms
  - Ditches, trenches, diversions
  - Terraces and benches
  - Chutes and downpipes
  - Seepage basins
  - Sedimentation basins/ponds
  - Levees
  - Addition of freeboard

Leachate and Ground Water Controls

- o Containment Barriers (generally used with dewatering and/or capping)

- Soil-bentonite slurry wall
- Cement-bentonite slurry wall
- Vibrating beam/asphalt wall
- Concrete wall/gunite
- Clay or mud wall
- Grout curtains
- Steel sheet piling
- Bottom sealing gel injection

Function Options

- Downgradient
- Upgradient
- Circumferential

o Ground Water Pumping (generally used with capping and treatment)

- Well points
- Deep wells
- Suction wells
- Ejection wells

Function Options

- Extraction/injection
- Extraction/seepage or drainage basin
- Extraction alone
- Leachate recycle
- Scavenger pumping
- Infiltration/collection trenches or galleries

o Subsurface Collection Drains

- French drains
- Tile drain
- Pipe drain (dual media drain)

Function Options

- Toe or interceptor drain
- Underdrains or relief drains

o Permeable Treatment Beds

- Limestone
- Activated carbon

o Capping (See A.)

Gas Migration Control (generally used with treatment)

- o Capping (gas barriers) (See A.)
- o Gas Collection and/or Recovery
  - Pipe vents
  - Trench vents
  - Active gas collection systems

Direct Waste Control

- o Tanks/Drum Removal
- o Liquid Removal
- o Incineration
  - Rotary kiln
  - Cement kiln
  - Fluidize bed
  - Multiple hearth
  - Molten salt
  - Plasma reactor
  - Liquid injection incineration
- o Solidification
  - Cement-based
  - Lime-based
  - Pozzolanic
  - Thermoplastic
  - Organic polymer
  - Self-cementing
  - Glassification
  - Miscellaneous solidifying materials (i.e., fly ash, saw dust...)
- o Aqueous and Solid Treatment
  - Biological
    - -Activated sludge (also deep shaft aeration; pure O_2 systems)
    - -Anaerobic, aerobic, faculative lagoons
    - -Composting
    - -Fluidized bed, bioreactor, and rotating biological discs
    - -Trickling filters
    - -Waste stabilization ponds

-Chemical

-Oxidation
-Neutralization
-Precipitation
-Ion exchange resins
-Liquid ion exchange
-Liquid/liquid extraction
-Chemical dechlorination

- Physical

-Flocculation, precipitation, and sedimentation
-Flow equalization
-Air stripping
-Carbon adsorption
-Reverse Osmosis
-Filtration/dewatering
-Dissolved air flotation
-Solar evaporation lagoons
-Oil/water separator
-Aeration (of soils)
-Wet air oxidation

o In situ Treatment

- Bioreclamation (microbial degradation)
- Neutralization/detoxification
- Oxidation/reduction
- Solution mining
- Precipitation
- Vitrification

o Private Treat Facility

o Publicly Owned Treatment works (POTW)

o Land Disposal

- Landfills
- Surface impoundments
- Land application

Soil and Sediment Containment and/or Removal

o Excavation

o Dredging

- o Grading (See B.)
- o Capping (See A.)
- o Revegetation (See B.)
- o Bulkhead Construction

Contaminated Water Supply and Sewer Lines

- o In Situ Cleaning
- o Removal and Replacement
- o Relocation of Intake Structures
- o Alternate Drinking Water Supply

  -Bottled water
  -Cisterns/tanks
  -Deeper or upgradient wells
  -Municipal water system
  -Relocation of intake

- o Individual Treatment Units

LEGAL REQUIREMENTS APPLICABLE TO SELECTED RESPONSE ACTIONS

Remedial Action	Requirement	Regulation	Source of Requirement
Hazardous Waste Management and Transportation			
Are hazardous wastes being treated, stored or disposed of onsite?	If, in the course of a remedial action, hazardous wastes are to be treated, stored or disposed of onsite, RCRA requirements may be applicable.	Federal requirements under the Resource Conservation and Recovery Act	RCRA §3005, 40 CFR 122
Will the remedy require siting or construction of a new hazardous waste management facility either at the site to be remedied or away from the site? Does the state regulate the siting of such a facility?	If a new hazardous waste facility must be created to handle the wastes, 44 states require state approval and/or permit as a precondition. Fourteen of these states could own and/or operate the facility themselves; 18 states preempt local regulation, and 8 allow for local veto of the state decision.	State Hazardous Waste Siting Permit	Hazardous waste laws or requirements in 44 states
Will the remedial action result in the construction of facilities to treat, store, or dispose of the hazardous wastes. Does the State require a permit or license for construction or modification of existing TSD facilities?	State permit or license required to construct hazardous waste TSD facilities.	State Permit for Construction of Hazardous Waste Treatment, Storage or Disposal (TSD) facility	Hazardous waste management laws in 23 states
After remedy, is site to continue to function as a TSD facility for hazardous wastes? Does State have RCRA Phase I and II authorization or separate State laws regulating existing TSD facilities?	Twenty states have Phase I authority to regulate existing TSD facilities to ensure compliance with "interim status" requirements under §3005 of RCRA. At least 5 states have applied for or been granted RCRA Phase II authorization to issue permits for storage and treatment facilities and incinerators. An additional 6 states also permit or license operation of TSD facilities and/or require compliance with financial responsibility and/or closure/post-closure requirements under state law only.	State Hazardous Waste Permit or License to Operate TSD Facility	Hazardous Waste Laws in at least 34 states, RCRA
Do activities at the site which are integral to the remedy require a local permit, license or payment of a fee or tax before operating as planned can begin?	Obtain permit or license approving operation of site after remedial action.	Local Operating permit or License for Remedy	Zoning, Building or Fire Code or local licensing laws (e.g. operation of a waste management facility)
After remedy, is site which has been subject to state regulation to be closed?	At least 28 states have requirements regulating closure and/or post-closure of an existing active waste management site.	State Acceptance of Hazardous Waste Site for Closure/Post-Closure	Hazardous Waste Laws in at least 28 states, RCRA

LEGAL REQUIREMENTS APPLICABLE TO SELECTED RESPONSE ACTIONS
(continued)

Remedial Action	Requirement	Regulation	Source of Requirement
Will hazardous waste be transported offsite?	If hazardous wastes for a remedial action are to be transported offsite, compliance with the RCRA manifest system may be required.	Federal Manifest for Transport of Hazardous Waste	RCRA §3002(5), 40 CFR 262
Will hazardous wastes be transported elsewhere?	In general, the manifest system requires the generator to use only licensed transporters and to designate only a permitted TSD facility to take delivery of wastes.	State Hazardous Waste Manifest	Hazardous waste management laws in 31 states
Will hazardous wastes or hazardous materials be transported elsewhere?	Obtain permit to transport hazardous wastes on public rights of way within state or license to operate a mode of transport for hazardous materials within the state.	State Permit or License for Transport of Hazardous Waste	Hazardous waste management laws, hazardous materials transport laws, or commercial driver licensing laws in 19 states
National Pollutant Discharge Elimination System			
Will pollutants be discharged directly into navigable waters?	If, in the course of a remedial action, the direct discharge of pollutants into navigable waters is part of the remedial action, an NPDES requirement may be applicable.	NPDES requirements under the Clear Water Act	CWA §402, 40 CFR 122
Will pollutants be discharged into navigable water? Does state have responsibility for issuing NPDES Permits?	If, in the course of a remedial action, the discharge of pollutants into navigable waters is contemplated and part of the remedial action, state NPDES requirements may be applicable.	State NPDES Permit	Water Pollution Control statutes of 33 states/ territories
Will remedy involve temporary or permanent discharges to sewer system?	Permit approval and/or fee for connection to public sewer system. Requirements as to quantity and quality of effluents discharged to sewer system.	Local Approval of Sewer Use Permit	State laws and/or constitution and local sewer connection and pretreatment ordinances, as well as some zoning, subdivision and/or building codes
Will remedy involve temporary or permanent point source discharges to surface waters?	Permit and/or plan approval for quality and quantity of direct discharge to surface waters.	Local Approval for Water Quality Discharge and/or Outfall Drainage Permit	State water pollution control laws and/or local health, water quality, subdivision, grading, building or zoning codes

LEGAL REQUIREMENTS APPLICABLE TO SELECTED RESPONSE ACTIONS
(continued)

Remedial Action	Requirement	Regulation	Source of Requirement
Will structures or work occur in or affect navigable waters of the United States?	If a remedial action involves the placement of structures or construction work (e.g., dredging, excavation) in or affecting navigable waters of the United States, a $10 permit may be required.	Structures of work in or affecting navigable waters of the United States	$10 of the Rivers and Harbors Act of 1899. 33 CFR 320-327.
Discharge of Dredged or Fill Material			
Will dredged or fill material be discharged into waters of the United States, including wetlands?	If a remedial action involves the discharge of dredge or fill material into the waters of the United States, including wetlands, a 404 permit may be required. Certify compliance with the state coastal zone management program. Permits must be consistent with the Wild and Scenic Rivers Act, the National Historic Preservation Act, the Endangered Species Act, the Coastal Zone Management Act, the Fish and Wildlife Coordination Act, Executive Orders, and Title III of the Marine Protection, Research, and Sanctuaries Act. Permits must not allow substantive impairment of anchorage and navigation of any navigable waters, nor an unacceptable adverse affect on municipal water supplies, shellfish beds and fishery areas, wildlife, or recreation areas.	Federal Permit to discharge Dredge or Fill Material into Waters of the United States, Including Wetlands	CWA §404, 33 CFR 320-327, 40 CFR 230
Will remedy require dredging or filling of surface waters?	Permit to dredge in surface waters or to fill or engage in construction in surface waters.	State Approval of Dredge/ Fill Permit	State enabling laws, enacted in order to comply with federal requirements or independently.
Sole Source Aquifers			
Is site location a designated sole source aquifer area?	If a remedial action is undertaken over a designated sole source aquifer area and underground injection of wastes is contemplated as part of the remedial action, sole source aquifer injection requirements may be applicable.	Federal Sole Source Aquifer Permit	SDWA §1424

LEGAL REQUIREMENTS APPLICABLE TO SELECTED RESPONSE ACTIONS
(continued)

Remedial Action	Requirement	Regulation	Source of Requirement
Underground Injection Control			
Are there to be underground injections of hazardous substances?	If, in the course of a remedial action, underground injection of hazardous substances will occur, a UIC permit or rule may be needed. Certify compliance with the state coastal zone management program. Permits must be consistent with the Wild and Scenic Rivers Act, the National Historic Preservation Act, the Endangered Species Act, the Coastal Zone Management Act, the Fish and Wildlife Coordination Act, and Executive Orders.	Federal Underground Injection Control Permit	SDWA §1421, 40 CFR 122
Does state regulate injection of wastes into deep wells?	If the remedial action involves, injection or or reinjection of wastes, a State permit may be required.	State Approval of Waste Injection in Deep Wells	State environmental protection laws and/or laws regulating oil and gas activities, especially recovery operations
Does planning for remedy require the drilling of new water quality monitoring wells? Does inital remedy or full remedy require the drilling of wells for water supply (especially potable supplies)? Does the remedy involve purging the aquifer?	County, city, special purpose district or state approval of the quality, quantity, source and/or use of ground waters or of activities which could degrade the quality or recharge of ground water.	Approval of Well Permit	State or local laws governing health, water conservation, or water use
Ocean Dumping			
Is ocean dumping contemplated as part of the remedial action?	If a remedial action involves the dumping of material into the ocean waters, the territorial sea of the United States, or the zone contiguous to the territorial sea of the United States (12 miles), "ocean dumping" requirements under MPRSA may be applicable from EPA or the Corps of Engineers (for dredged material). Permits must comply with EPA and Army requirements for monitoring and surveillance of transporation or dumping. Permits must not allow navigation to be unreasonably impaired.	Federal Ocean Dumping Requirements	MPRSA §102, §103, 40 CFR 220-224, 33 CFR 220, 224

LEGAL REQUIREMENTS APPLICABLE TO SELECTED RESPONSE ACTIONS
(continued)

Remedial Action	Requirement	Regulation	Source of Requirement
Air Permits and Standards			
Will the proposed remedy have an adverse effect on air quality?	Federal agencies are required to comply with federal, state, and local requirements -- especially with State Implementation Plans (SIPs) -- for the control and abatement of air pollution. If a proposed EPA action may adversely affect air quality, the responsible EPA official is required -- by CFR 6.303(b) -- to consult with appropriate state and local agencies on whether the action conforms with the SIP.	Overall Compliance with the Clean Air Act	Clean Air Act, §118(a) and 176(c), 40 CFR 6.303
Will the proposed remedy involve air emissions? Is the site in a PSD area?	A major source of air pollutants in PSD area must be permitted by the state and is subject to requirements applicable to PSD areas.	State Permit Requirements for Emissions in PSD Areas	Clean Air Act, Part C, State Implementation Plans
Will the proposed remedy involve air emissions? Is the site in a non-attainment area for a pollutant emitted?	A major source located in a non-attainment area must comply with requirements applicable to non-attainment areas.	State Permit Requirements for Emissions in Non-Attainment Areas	Clear Air Act, Part D, State implementation Plans
Will the proposed remedy involve emissions of hazardous air pollutants?	Significant sources of pollution listed as hazardous are subject to NESRAPs.	National Emissions Standards for Hazardous Air Pollutants	Clean Air Act, §112, State Implementation Plan
Other Federal Laws			
Will the proposed remedy affect the "wild, scenic, or recreational river status" of a river on the Nationwide Inventory?	Act prohibits EPA from assisting by license or otherwsie the construction of any water resources project that would have a direct adverse effect on the values for which a national wild and scenic river was established, requires a federal agency to notify the Secretary of Agriculture for water resources projects that will adversely affect a national wild and scenic river, and for activities that may affect rivers designated in the Act for potential addition to the national wild and scenic river system.	Preservation of Rivers on the National Inventory	Wild and Scenic River Act § 7, 40 CFR 6.302(e)

LEGAL REQUIREMENTS APPLICABLE TO SELECTED RESPONSE ACTIONS
(continued)

Remedial Action	Requirement	Regulation	Source of Requirement
Will the proposed remedy jeopardize the continued existence of any endangered or threatened species or adversely affect its critical habitat?	Requires federal agencies to request of the Secretary of Interior information on whether any endangered or threatened species may be present in the area of proposed agency action. If the Secretary determines such a species may be present, the federal agency must conduct a biological assessment.	Protection of Threatened or Endangered Species and Their Habitats	Endangered Species Act § 7, 50 CFR Part 402
Does the proposed remedy involve the modification of any body of water?	The Act requires that federal agencies, before issuing a permit for the modification of any body of water, consult with the appropriate state agency exercising jurisdiction over wildlife resources. Consultation with the U.S. Fish and Wildlife Service is also required.	Conservation of Wildlife Resources Applies to federally financed action and permit programs	Fish and Wildlife Coordination Act
Will remedy of the site impact property on the National Register of Historic Places?	Must observe Act's procedures if property on the National Register of Historic Places is within the area of the remedy's environmental impact. Consultation with the Advisory Council on Historic Preservation, State Historic Preservation Officers, and certain other individuals and organizations is also required.	Preservation of Historic Places	National Historic Preservation Act of 1966
Does the proposed remedy threaten loss or destruction of relevant data?	Establishes requirements relating to potential loss or destruction of significant scientific, historical, or archaeological data as a result of any proposed remedy. The Secretary of Interior must be notified if a federal agency finds that its activities in connection with any federal construction project might cause loss or destruction of such data.	Preservation of Scientific, Historial or Archaeological Data	Archaeological and Historic Preservation Act of 1974
Is the site close to shoreline (coastal, lake, river, and/or wetlands) of California, Delaware, Washington, Wisconsin, Florida, Hawaii, Maine, Michigan, Minnesota, Mississippi, North Carolina, Rhode Island, Texas or Virginia?	CZMA requires consistency with Federally-approved State Coastal Zone Management Programs. EPA cannot approve state and local applications for federal assistance for projects affecting the Coastal Zone unless state and local agency views are included.	State Approval of Shoreland Use	Coastal Zone Management Act of 1972, 15 CFR Part 90, fourteen states have shoreland management statutes giving them regulatory powers over land use along shorelines

LEGAL REQUIREMENTS APPLICABLE TO SELECTED RESPONSE ACTIONS
(continued)

Remedial Action	Requirement	Regulation	Source of Requirement
Does the remedial action involve any displacement or property acquisition?	Acquisition of interest in real property in connection with any federally-assisted project or any displacement of persons, businesses or farm operations must be conducted in compliance with the Act and its regulations. These cover moving and related expenses, replacement housing, relocation assistance advisory services, and acquisition of real property. Consultation is required with the appropriate area office of HUD. In addition, no project causing displacement may be undertaken unless the Administrator determines that replacement housing will be consistent with Title VIII of the Civil Rights Act of 1968.	Relocation Assistance and Property Acquisition	Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, 40 CFR 4
Is compensation for anticipated losses of real or personal property or loss of use of such property necessary in order to preclude damaged parties from bringing legal actions which could delay the implementation of the remedy? Is compensation necessary to avoid a taking of private property without just compensation?	Most remedies will involve altering privately owned real or personal property (e.g. topsoil removal, demolition to obtain access, restriction of future access to property, etc.) While CERCLA clearly authorizes such response, such actions may nevertheless also require notice and compensation for anticipated loss of or loss of use of privately owned real or personal property.	Negotiation and Payment of Damages to Real or Personal Property necessary to Remedy	CERCLA §107, Federal Tort Claims Act, Federal and State common law, possibly state and local statutes
Are Radionuclides present at the site? Is it proposed the remedial action result in their disposal within the state?	Four states require state concurrence to dispose of radioactive wastes, 5 states require state approval, and 11 states require legislative approval.	State approval or concurrence on disposal of radioactive wastes	Section 274 of the Atomic Energy Act, the Low-Level Radioactive Waste Policy Act of 1980, and enabling legislation in 20 states
Are high level radioactive wastes present at the site? Is the site located in Illinois, Montana, South Dakota, or Texas?	State law prohibits the disposal of high-level radioactive wastes within the state.	State ban on disposal of high-level radioactive wastes	Section 274 of the Atomic Energy Act, the Low-Level Radioactive Waste Policy Act of 1980, and enabling legislation or interstate compacts in 4 states
Are radionuclides present at the site? Is the site located in Alabama, Michigan, Texas, Vermont or West Virginia, or after July 1, 1983 in	Prohibition against the disposal of any radioactive wastes from other states within the boundaries of the state or of the states signing the interstate compact.	State ban on disposal of out-of-state generated radioactive wastes	Section 274 of the Atomic Energy Act, the Low-Level Radioactive Waste Policy

LEGAL REQUIREMENTS APPLICABLE TO SELECTED RESPONSE ACTIONS
(continued)

Remedial Action	Requirement	Regulation	Source of Requirement
Washington, Idaho, Oregon, Alaska, Hawaii or Wyoming?			Act of 1980, and enabling legislation in 5 states, and proposed interstate compact in at least 6 states.
Are radionuclides present at the site? Will radionuclides be transported elsewhere?	15 states require transporters to have special licenses, 9 states require transporters to be registered, or certified, and 11 states require transporters to have a permit. In addition, 20 states have adopted pre-notification requirements for transporters, 12 have defined financial responsibility transporter limits, and 24 states have enacted some form of transporter monitoring, surveillance and inspection program. Several states ban transport of radionuclides in certain areas of the state.	State approval for transport of radionuclides	Section 274 of the Atomic Energy Act, the Low-Level Radioactive Waste Policy Act of 1980, and enabling legislation in 32 states.
Publication of Federal Register of applicable projects.	Effective 10/1/83, new regulations at 40 CFR 29 establish procedures for state and local coordination and review of proposed EPA assisted projects. The EPA Administrator is required to: communicate with state and local officials to explain the project, consult with other affected federal agencies, and provide a comment period for state review.	Intergovernmental review of Federal Programs	Executive Order 12372, 40 CFR 29, (Replaces state and areawide coordination process required by OMB Circular A-95.)
Does remedial action involve construction or property acquisition? Is site located in a National Flood Insurance Program Community?	Requires purchase of flood insurance before federal funds can be used to acquire real or nonexpendable personal property or for construction purposes in an identified special flood hazard area that is located within any community currently participating in the National Flood Insurance Program.	Floodplain Insurance	Flood Disaster Protection Act of 1973 and National Flood Insurance Act of 1968, 24 CFR 1909
Is remedial action in floodplain subject to E.O. 11988?	Requires Federal agencies to evaluate potential effects of planned actions in a floodplain in order to reduce risk of flood loss and restore and preserve the natural and beneficial values served by the floodplain. Requires notification of state agencies and public review of proposed activity. Facilities must be construed consistent with standards established under the National Flood Insurance Program.	Response in a floodplain	Executive Order 11988

LEGAL REQUIREMENTS APPLICABLE TO SELECTED RESPONSE ACTIONS
(continued)

Remedial Action	Requirement	Regulation	Source of Requirement
Is the site within a floodplain (includes Flood Hazard Boundary Map areas, but may be larger) in Arizona, Arkansas, California, Colorado, Connecticut, Hawaii, Indiana, Iowa, Maine, Maryland, Michigan, Minnesota, Montana, Nebraska, New Jersey, North Carolina, Oklahoma, Vermont, or Wisconsin?	State has authority to regulate the use of floodplains. Many sites are in floodplains.	State approval of flood plain land use or development	Nineteen states have authority to regulate the use of floodplains as a result of land use or resource management statutes
Is the remedial action in a wetland? Is there any practicable alternative?	To the extent permitted by law, prohibits Federal agencies from undertaking or providing assistance for new construction located in wetlands unless the agency first finds that there is no practicable alternative and the proposed construction includes all practicable means of minimizing harm to wetlands.	Response in a Wetland	Executive Order 11990
Is the site in wetlands of Connecticut, Delaware, Florida, Georgia, Louisiana, Maryland, Massachusetts, Minnesota, New Hampshire, New Jersey, New York, North Carolina, Rhode Island, Vermont, Washington, Wisconsin?	State has authority to plan or review local plans or the ability to control land use in or affecting wetlands. Many sites are in wetlands.	State approval of wetlands use	Sixteen states have wetlands management statutes
	Fund-financed remedial actions are exempt from the NEPA requirements to prepare an EIS, provided that: (1) standards exist that ensure adequate consideration of environmental issues, and (2) opportunity for public comment is provided prior to the selection of remedial alternatives.	Federal Environmental Assessment/EIS	NEPA §102(2)(c)
Does state law require an assessment of environmental impact? If so, unless there is a finding of no significant impact, preparation of an impact statement could be required.	States may determine that a state environmental assessment or impact statement is required by state law.	State EIA or EIS	17 states' laws require EIS (in several states the source of the requirement is a state executive order, rather than an explicit statute)
Will surface waters be diverted or channelized?			

LEGAL REQUIREMENTS APPLICABLE TO SELECTED RESPONSE ACTIONS
(continued)

Remedial Action	Requirement	Regulation	Source of Requirement
Other State and Local Laws			
Does state regulate surface water course changes or alternation of riparian conditions?	If the remedial action requires temporary or permanent surface water diversion or channelization, state approval may be required.	State approval of surface water diversion	State water rights law, state constitution, or state environmental protection laws
Does remedy involve additions to a new public water supply system (generally one with 4 or more service connections or regular service to at least 25 individuals for at least 60 days annually)?	Permit for development of a new potable water system or additions to an existing system. May also require inspection and approval of completed facilities prior to operation.	State approval of water supply system additions or developments	State public health or environmental laws
Is there a potential during remedial action for fire, explosion, accidental release of additional hazardous substances, sabotage or vandalism, natural disaster, subsidence, temporary loss of potable water supplies, temporary evacuation of housing, violent public protect, rumor-induced panic, etc.?	Requirement for such state and local support dependent on each specific site situation and remedy.	Provision for emergency support from local and state authorities during construction or remedy	General powers to protect public health and safety
Will the time of year or type of construction increase erosion problems?			
Is the site in the states of New York, New Jersey, Neveda, or California?	Land use consistent with regional plans or requirements. Powers may also include state veto or local approval, state override of local denial, or enforcement of State or local regulations.	Regional agency approval of land use	Four states have laws giving regional agencies regulatory power over land use in large portions of each state
Is the site in the Adirondacks (New York), Hackensack Meadlowlands (New Jersey) the shorelands of San Francisco Bay, or the vicinity of Lake Tahoe?			
Is the site in Colorado, Florida, Hawaii, Maine, vermont, Maryland, Oregon, or Neveda?	Land use consistent with state plans or requirements. Powers may also include state veto of local approvals, state override of local denial, or enforcement of state or local regulations.	State approval of land use (critical areas)	Eight states have laws giving them statewide regulatory powers over land use and control, primarily in areas of "critical concern"
Is the site in a state-designated review district or area of critical concern?			

LEGAL REQUIREMENTS APPLICABLE TO SELECTED RESPONSE ACTIONS
(continued)

Remedial Action	Requirement	Regulation	Source of Requirement
Will the remedy require land grading? Is the site in a "critical area", flood plain, wetland, or agricultural conservation zone?	Requirements affecting land slope and cover, surface water management, alternation of natural contours or cover by excavation or fill.	Local approval of grading (erosion control) permit	Local grading ordinances or erosion control ordinances. In some states, such permits are also a part of state land use controls
Does the zoning code and map permit the intended use of the site after the remedial action?	Use, and conditions of use, of site after remedy may be affected by zoning ordinance and zoning map. If use is not allowed, then zoning map and comprehensive plan may require notification, a conditional use permit.	Local approval of rezoning or conditional use permit	Local zoning codes
Do the conditions under which the site will be maintained and used after remedy conform to the requirements of the zoning ordinance?	The conditions of use of the site after the remedy may be affected by the zoning ordinance as well as the zoning map. Special exceptions may be granted to the zoning ordinance for conditions of use which are non-conforming.	Local approval of zoning special exception	Local zoning codes
Do the conditions under which the site will be maintained and used after remedy conform to the requirements of the zoning code and map.	The use of the site after remedy may be affected by the zoning ordinance and zoning map. A zoning variance may be issued if there is non-compliance but the local jurisdiction does not wish to modify the code or map, other than for the property in question.	Local approval of zoning variance	Local zoning codes
If remedy requires changing property boundaries, installation or changes in roads, utilities, acquisition of easements, or similar changes, subdivision approval may be required.	Subdivison approval ensures the locality that public improvements will meet local requirements and it regulates changes in property boundaries.	Local approval of site plan (plat plan)	Local subdivision regulations (often incorporated by reference are other construction requirements for streets, utilities, etc.)
Has the remedy required issuance of a building permit? Does the building code require a local use permit or certificate of compliance upon completion of the permitted work or for such a use?	Demonstration through presentation of evidence or onsite inspection that remedial action complies with the requirements of local health and safety laws and ordiances.	Local approval of use permit	Local Building Code
Will any building, construction, or demolition activities occur? Does the city or county have a building code?	Obtain building permit for construction of site improvements planned in remedial action.	Local building (construction) permit	Local building code

LEGAL REQUIREMENTS APPLICABLE TO SELECTED RESPONSE ACTIONS
(continued)

Remedial Action	Requirement	Regulation	Source of Requirement
Is right-of-way needed as a result of weight or dimensions of equipment or anticipated blockage of one or more lanes of traffic on a public right-of-way?	Obtain local approval of use of temporary or permanent right-of-way on public lands (streets) bordering on site, as necessary, for access during remedial action and/or thereafter.	Local approval of use of public right-of-way	Local building code, grading or subdivision ordiance, or public safety laws
Will the remedy require electrical work to be installed? Does the city or county have an electrical code or ordinance?	Obtain electrical permit for any wiring to be installed.	Local electrical permit	Local electrical code
Is demolition of existing property improvements required or blasting on land surface or substrata required?	Obtain permit approving demolition and/or blasting planned during remedial action.	Local demolition (blasting) permit	Local building codes or ordinances governing subdivision, grading, public safety, and/or hazardous materials
Is fee simple acquisition of private property required to implement or operate and maintain the remedy, or to insure clear access to real and personal property (e.g. where there are creditors, liens, deed restrictions, surviving beneficiaries, convenants, or no private owners of the site can be found and therefore, escheat is necessary)?	In some instances, the cost-effective remedy may require acquisitions of fee-simple title in the site or a buffer zone about the site. In other instances, the cost-effective remedy may require state or local government operation and maintenance of the remedy on a long-term basis and this may necessitate public acquisition of the property. In other instances, (e.g.abandonment absence of legal heirs, etc.) site acquisition may be needed.	Acquisition of fee simple title to real property and record deed for replatted land	Common law or power of eminent domain, state or local real property title recordation law
Will the legal boundaries of the site need to be altered as part of the remedy? Will ownership of the site be altered for the remedy by sale, condemnation, tax delinquency, bankruptcy, foreclosure, etc.? Will any right of use of the property change hands (e.g. easement granted, water or mineral rights changed, public dedication of all or portions of site)?	In most states, cities or counties, a change of property ownership, right of use, or legal boundaries is unlawful or legally invalid unless the county or municipality has approved and failed a revised plat and recorded the deed. Such changes may be necessary to remedying the site, to operating and maintaining the remedy, to provide a buffer between conflicting land uses, or to protect the public investment in the remedy.		

LEGAL REQUIREMENTS APPLICABLE TO SELECTED RESPONSE ACTIONS
(continued)

Remedial Action	Requirement	Regulation	Source of Requirement
Do others have a prior claim upon the property or its use which will interefere with the remedy (e.g. creditors, liens, convenants, surviving beneficiaries, and restrictions, etc.)?			
Decision to undertake remedial action. Determination of whether site was owned by state or local government at time of disposal. Are bonds the preferred source of capital to finance the match required by CERCLA §104(c) (3)?	Some states (e.g. California) require that the state review and approve the fiscal soundness of local government bonds prior to issuance. Where the bond is to be issued as long term indebtedness of the state, the state legislature must authorize the bond sale.	State approval of state or local bond sale	State laws of municipal incorporation or authorization for special purpose districts. Sometimes, state constitution
Will match required by CERCLA §104(c) (3) be financed by teneral obligation bonds?	Voters must approve general obligation bonds and certain other long-term debt instruments prior to their issuance in most, but not all, jurisdictions.	Voter approval of general obligation bond sale	State laws of municipal incorporation or authorization for special purpose districts or state constitution or municipal charter
Decision to undertake remedial action. Determination of whether site was owned by political subdivision of state at time of disposal. Are bonds the preferred source of capital to finance the required match?	Local legislative body (city council, board of supervisors, governing board, etc.) must approve all local general obligation bonds and certain other bonds prior to their issuance. Bonds may be used as source of matching funds required by CERCLA §104 (c) (3).	Local approval of bond sale	State laws of incorporation for municipalities, state authorizing statutes for special purpose of districts, and/or municipal charters

APPENDIX F

WORK PLAN OUTLINE FOR RI/FS

APPENDIX F
REMEDIAL INVESTIGATION REQUIREMENTS

PROJECT OPERATIONS PLAN

The Project Operations Plan (POP) will be created to identify detailed procedures for conducting all field activities supporting the remedial investigation. It will be based on the Region IV Standard Operating Procedures and Quality Assurance Manual. The POP is subject to revision throughout the investigation to accommodate unexpected field conditions.

HEALTH AND SAFETY

A portion of the POP presents the health and safety requirements for each task and/or phase of the RI. This section identifies individuals responsible for monitoring all field activities for compliance with the established health and safety procedures. The health and safety component of the POP describes personnel monitoring and decontamination procedures in detail. It also addresses health and safety training procedures and requirements for all onsite personnel, including subcontractors.

SAMPLING AND ANALYSIS

This portion of the POP presents detailed descriptions of the sampling locations, methodologies, equipment requirements, decontamination procedures, sample codes, sample handling/shipping procedures (chain-of-custody), and mobilization activities; and identifies the field team for each of these tasks. The POP also presents details of sample preparation/preservation, sample bottle requirements, and identifies the methods to be followed for sample analyses.

QUALITY CONTROL

Methods and approaches for providing quality control of field sampling and laboratory activities are described in detail. Quality control procedures

cover items such as, calibration and maintenance of field and laboratory equipment, and analyses of duplicate, blank, and spiked samples. Field/sampling blanks are also routinely included as a quality control check on sampling procedures.

DATA MANAGEMENT

Data management procedures are developed and included to ensure reproducibility of all field activities. Field log books are maintained for each activity, and include detailed descriptions of all sampling procedures, individuals responsible for collecting samples, etc. The data management section of the POP also establishes procedures for managing the data generated by the laboratories, subcontractors, etc., to maintain constant control and accountability. Further, it provides for data security, file control, and complete documentation of the project. This information is compiled and presented in greater detail in a separate Data Management Plan.

STUDY AREA SURVEY

SITE BOUNDARY SURVEY

The Site Boundary Survey is based on results from the initial site evaluation and indicates the areal extent of the investigation.

SENSITIVE RECEPTOR AND TRANSPORT PATHWAY IDENTIFICATION

Based on identified transport pathways, potential receptors of offsite migration of contaminants should be identified.

SOURCE CHARACTERIZATION

The objective of source characterization is to determine the source and extent of contamination of the site and its environs. This includes all sampling and analysis which addresses these factors.

SITE CHARACTERIZATION

The objective of site characterization is to evaluate contaminant migration from the site. Data collected under this task will provide information needed to evaluate pathways for offsite migration of contaminants and to characterize the potential for performing technological, public health, and environmental analyses.

FEASIBILITY STUDY TESTING

Feasibility testing will include conducting treatability studies and bench-scale tests to evaluate the applicability and effectiveness of potential technologies for treating contaminated soils and ground water.

DATA REDUCTION AND VALIDATION

The data reduction process may include computer analysis, graphics and/or other methods that aid in the analysis of the data and conceptualization of the results. All data generated during the site investigation should be reviewed for completeness, accuracy, and adherence to QA/QC standards.

CONTAMINANT PATHWAY AND TRANSPORT EVALUATION

The remedial alternative eventually selected for this site will depend on the source, level, and extent of onsite contamination. Contaminant transport modeling of the site may be performed, if necessary, to define the areal extent and concentration of contaminants, and to predict future dispersion and migration patterns as required by the NCP. The model should have the capability of simulating flow and transport in detail over the areas of current and potential influence of contaminant plumes.

PUBLIC HEALTH EVALUATION

The Public Health Evaluation (PHE) should be performed in a manner consistent with current (draft) EPA guidance documents. The PHE should be designed and performed to constitute the public health and environmental

analysis of the "No Action" remedial alternative. According to the EPA Guidance Document, PHEs are conducted in three steps:

- o Baseline site evaluation (preliminary evaluation and classification that all sites must undergo)
- o Exposure assessment (analysis of the extent and duration of human exposure to site contaminants; this step applies only to sites for which management of migration remedial alternatives, not just source controls, are considered)
- o Standards analysis (comparison of projected environmental concentrations to appropriate ambient standards or criteria)

BASELINE SITE EVALUATION

The information collected during the RI on site background, disposal history, site environmental data, onsite and offsite contaminant levels, and human and wildlife populations should be summarized and presented in concise form. This section of the PHE may be consolidated with or incorporated by reference into the corresponding sections of the RI Report.

EXPOSURE ASSESSMENT

Exposure assessment includes the following elements:

- o Identification of chemicals present at the site and selection of indicator chemicals (based on toxicity, persistence, mobility, and quantity present)
- o Identification of points of potential human exposure and exposure pathways for each remedial alternative considered
- o Characterization of populations potentially at risk
- o Estimation of all exposure points and the environmental concentrations of each indicator substance

PREPARE REMEDIAL INVESTIGATION REPORT

PREPARE DRAFT REMEDIAL INVESTIGATION REPORT

Following completion of laboratory and field data evaluation, a Draft RI Report should be prepared for submission to EPA.

PREPARE FINAL REMEDIAL INVESTIGATION REPORT

After EPA review of the Draft Remedial Investigation Report, comments generated during the review should be addressed and incorporated into the Final Remedial Investigation Report.

COMMUNITY RELATIONS

A Community Relations Plan should be prepared and implemented.

QUALITY ASSURANCE

All technical aspects of the RI/FS and all personnel engaged in execution of this project are subject to EPA Region IV quality assurance programs. A detailed Quality Assurance Plan covering all of the activities of the RI/FS should be prepared and submitted concurrently with the draft work plan. The activities and products covered by this Quality Assurance Plan and described under EPA Region IV Standard Operating Procedures (SOPs) include, but are not limited to:

- o All technical deliverables
- o Graphics
- o Reports and documents
- o Analytical procedures and data validation
- o Sampling procedures
- o Calibration of field and laboratory instruments
- o Sample custody
- o Data reduction and processing
- o Field methods
- o Laboratory methods

APPENDIX F
FEASIBILITY STUDY REQUIREMENTS

The primary requirements of the feasibility study (FS) are:

- To identify the remedial alternatives and technologies available based on known site characteristics and levels of contamination onsite and/or offsite
- To perform a detailed evaluation of the limited number of alternatives remaining after the initial screening process
- To identify the most cost effective remedial alternative that is technologically feasible, and uses acceptable engineering practices
- To prepare a conceptual design for the remedial alternative unless the no action alternative is selected

PRELIMINARY IDENTIFICATION OF REMEDIAL ALTERNATIVES

Alternatives that address each of the five categories described in the NCP Section 330.68 (f) Development of Alternatives, have been identified in the body of this report. During the early stages of the RI, these preliminary alternatives, and possibly others, will be more fully developed with regard to the type of response action required, e.g. source control, control of offsite migration, and/or removal action.

SCREENING OF REMEDIAL ALTERNATIVES

All of the alternatives identified for each of the five required categories will be screened to narrow the range of choices. Some alternatives may be discarded based on the results of the remedial investigation. The order of criteria for screening each alternative will be (1) technical feasibility, (2) environmental and public health and safety performance, and (3) cost.

Technical Feasibility Screening

The first level of screening should eliminate those alternatives that are not based on proven/acceptable technology or are not compatible with known waste and site characteristics. The final technical screening of each alternative should be based on technical reliability, as determined by appropriate technical criteria developed to meet specific objectives for site remediation and implementation screening. Implementation screening should evaluate specific site characteristics (geology, topography, etc.) and waste characteristics (types, concentrations, and compatibility).

Environmental and Public Health Screening

The Public Health Evaluation (PHE) constitutes the public health and environmental analysis of the "no action" remedial alternative. Using this analysis as a baseline, a comparative analysis should be performed for alternative remedial measures. These evaluations should enable an assessment to be made of the extent to which remedial actions will affect the potential for exposures and risk. Also, an important component of the assessment of any remedial alternative that involves removal and offsite disposal of hazardous materials, is consideration of exposures that may result during excavation and transportation.

Cost Screening

Cost estimates for each of the alternatives remaining under consideration should be prepared. Those alternatives whose associated costs are higher than other alternatives but do not provide significantly greater benefit or technological reliability should be identified and may be eliminated.

REMEDIAL ALTERNATIVES ANALYSIS

Following completion of the screening process, each of the remaining alternatives should be subjected to detailed analyses as outlined below:

- o Technical Feasibility Analysis
  - Reliability
  - Implementation
  - Safety Considerations
- o Public Health Analysis
  - Exposure Assessment
  - Standards Analysis
- o Environmental Assessment
- o Institutional Analysis
- o Cost Analyses
  - Cost Estimate
  - Present Worth Analysis
  - Sensitivity Analysis

The results of the analysis for each alternative should be tabulated in a form suitable for a comparative evaluation. In order to conceptualize the analysis for each alternative, the following supporting information should be provided, as necessary:

- o Basic component diagrams for each alternative
- o Major equipment needs and utility requirements
- o Conceptual drawing of the site layout
- o Preliminary implementation schedule including procurement, construction, and operating time required to achieve objectives

COMPARATIVE EVALUATION OF ACCEPTABLE ALTERNATIVES

The results of the detailed analyses of the alternatives should be organized to ease comparative study and to allow ranking of the alternatives. The ranking should take into consideration the following five major factors:

- o Technical considerations
- o Incremental cost-benefit analyses
- o Institutional considerations

- o Environmental impacts of implementation
- o Impact mitigation

The comparative evaluation and ranking of alternatives should be integrated into a single analysis that provides a detailed rationale supporting the recommended alternative(s). The cost effectiveness portion of the comparative evaluation should be summarized in a Cost Effectiveness Report.

FEASIBILITY STUDY REPORT

Draft Feasibility Study Report

A draft report summarizing the results of alternatives development, screening, and analysis should be prepared, along with procedures followed during completion of the feasibility study. The FS report should include the results of investigation and analysis of both source control and site characterization.

Public Meeting

The Draft Feasibility Study Report should be subject to the public review/comment process. This process includes a public meeting, which should be undertaken as part of the community relations program as directed by EPA.

Final Feasibility Study Report

Following EPA and public review/comment, the Draft Feasibility Study Report should be revised to address and/or incorporate review comments into a Final Feasibility Study Report.

DECISION DOCUMENT PREPARATION

After the final feasibility study report has been submitted to EPA for approval, EPA will prepare a Record of Decision (ROD) document for final approval by Region IV on the selected remedial alternative.

PREPARE FINAL REMEDIAL INVESTIGATION REPORT

After EPA review of the Draft Remedial Investigation Report, comments generated during the review should be addressed and incorporated into the Final Remedial Investigation Report.

COMMUNITY RELATIONS

A Community Relations Plan should be prepared and implemented.

QUALITY ASSURANCE

All technical aspects of the RI/FS and all personnel engaged in execution of this project are subject to EPA Region IV quality assurance programs. A detailed Quality Assurance Plan covering all of the activities of the RI/FS should be prepared and submitted concurrently with the draft work plan. The activities and products covered by this Quality Assurance Plan and described under EPA Region IV Standard Operating Procedures (SOPs) include, but are not limited to:

- o All technical deliverables
- o Graphics
- o Reports and documents
- o Analytical procedures and data validation
- o Sampling procedures
- o Calibration of field and laboratory instruments
- o Sample custody
- o Data reduction and processing
- o Field methods
- o Laboratory methods

SYSTEM AUDITS

Comprehensive records should be maintained to provide evidence of quality assurance activities. Procedures for recording all aspects of the quality assurance program should be written and placed on file. Appropriate personnel should be trained in the use of these procedures.

The proper maintenance of quality assurance records is essential to provide support in evidentiary proceedings.

Access to working files should be restricted to project personnel. Access to all files containing quality assurance records should be further restricted. Upon termination of an individual task or work assignment, working files should be processed for storage as quality assurance information.

Periodically, a system audit should be conducted to ensure that the quality assurance objectives are being achieved. Procedures for conducting audits should be clearly defined and established before audits are initiated.

TECHNICAL MANAGEMENT

MONTHLY REPORTS AND MEETING

Monthly progress meetings and/or reports to EPA Region IV should include, but are not limited to:

- o Anticipated problem areas
- o Resolved problems
- o Deliverables submitted
- o Planned activities for the following month
- o Schedule changes